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Family Resemblances Among American Men of Science

By
DEAN R. BRIMHALL



Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy,
in the Faculty of Philosophy,
Columbia University

Reprinted from
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Dissertation

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FAMILY RESEMBLANCES AMONG AMERICAN MEN
OF SCIENCE

FAMILY RESEMBLANCES AMONG AMERICAN MEN OF SCIENCE

DR. DEAN R. BRIMHALL

SECRETARY OF THE PSYCHOLOGICAL CORPORATION

THE fascinating problems that concern the causes of individual and group differences among human beings are still with us. Since Galton set out to prove that "a man's natural abilities are derived by inheritance under exactly the same limitations as are the form and physical features of the whole organic world" the biological sciences have made many and notable contributions to the fund of knowledge concerning the derivation "of the form and physical features of the organic world." But the influences by which individual and group differences come about, particularly differences in intellectual performance, seem to have been singularly neglected.

The problem has been avoided partly because of the nature of the material. Human beings are not only complicated in organic construction, but they are mongrel in breed, the period between generations is long and direct experimentation impossible. Few scientific problems are more likely to be disturbed by the bias of the experimenter. The American millionaire or European aristocrat explains differences in the wealth gathering or keeping performance of human beings in terms of innate ability. To the socialist the expression "royal minds" has little basis in fact. Laws, taboos, economic and social conditions are thought to be the proper explanations of differences in human behavior. So deeply do the facts concern the fundamental concepts about the organization of society that debate with its anecdotal method should be supplanted by objective method of the best sort available.

The method of approach used in this study is statistical. The investigation represents an attempt to determine some of the differences or resemblances, the causes

of which have been so often the subject of debate and argument. It is necessary to determine what resemblances or differences exist before causes can be explained. This is a study of family resemblances in intellectual performance, particularly in the field of science.

By limiting the problem to the measurement of resemblances the advice of a gifted and successful worker in this field is followed. He writes:

It is impossible at present to estimate with security the relative shares of original nature, due to sex, race, ancestry and accidental variation, and of the environment, physical and social, in causing the differences found in men. One can only learn the facts, interpret them with as little bias as possible, and try to secure more facts.¹

By this same limitation it is hoped that a serious and common error will be entirely avoided, namely, the failure to realize the twofold nature of the problem of inheritance as ordinarily discussed. The following analysis is so clear and the need of it so general that it is given at length.

Most sociological writers and some biologists are confused in their use of the concept of heredity. When there is discussion of the relative influence on performance of heredity and environment, by heredity there is sometimes understood the original constitution of the individual and sometimes his resemblance to parents and other relatives. It is conceivable that the original constitution of son and father might be exactly the same and yet the individual be so plastic to environment that under different conditions there would be but slight similarity between their performances. It is also conceivable that there might be no similarity between the original constitution of son and father, and yet the performance of each be determined by his original constitution almost without influence from environment. Under which of these extreme hypotheses would the current sociologist call heredity strong or weak? The word heredity should be reserved for resemblance due to a common germ plasm and some other word found for the constitution of the fertilized ovum or zygote; perhaps the best that can be done is to use this uncouth word. We can then discriminate between the two distinct questions: What is the resemblance between the zygotes of two brothers? How far does the zygote of an individual determine his performance as an adult?²

¹ Thorndike, "Educational Psychology," Vol. III, p. 310.

² J. McKeen Cattell, "Families of American Men of Science," *Pop. Science Monthly*, May, 1915.

It must not be inferred that this study is an attempt to determine "how far the zygote of an individual determines his performance" or "what is the resemblance between the zygotes of two brothers." It is primarily a statistical measurement of resemblance in performance with particular reference to performance in science. With the results of these measurements at hand, something about the resemblances of the zygotes of near relatives and about how far the zygote of an individual determines his performance may be estimated.

By resemblance is meant, not identity, but degree of similarity. Galton, with the idea of particulate inheritance in mind, early insisted on measuring resemblances as deviations from an average. He justly claims to have been the first to "introduce the law of deviations from the average into the discussions on heredity."³ Almost forty years later he is found insisting that "probability is the foundation of eugenics."⁴ It is here that the statistical method avoids the pitfalls of proof by anecdote. Given a group, selected for some particular sort of performance, the number in any particular degree of relationship showing similar performance may be determined and compared with a similar group of the generality. This is the method used in this study.

The group studied consists of approximately 1,000 American men of science and their families. The wives and the near relatives of the wives of the men of science are included in the data, and the results of the comparisons offer perhaps the most unique contribution of the investigation. The statistical data include only relatives of a degree no more remote than first cousin. These relatives are: brothers and sisters, sons and daughters, fathers and mothers, nieces and nephews, uncles and aunts, grandparents and first cousins.

It may be well here to anticipate a criticism of the use of the term resemblance. Since the group of men of science is made up of persons of known distinction and since

³ "Hereditary Genius," Preface, 1869.

⁴ Spencer lecture, 1907.

resemblance of near relatives is measured in terms of the number of the latter who become distinguished, it is assumed that distinction in any intellectual performance is evidence of resemblance. Thus, a psychologist whose cousin is a psychologist may be said without much fear of contradiction to resemble that relative, but does he really resemble his brother, who is a well-known judge? Does he resemble his distinguished father, a former president of the University of Michigan, a gifted administrator?⁵ Apparently, that has been assumed. The fact is, they do resemble each other in so far as they vary in the same direction from the average person in the direction of performance.

The selection of the group of scientific men used has become a classic in individual psychology and need not be related in detail here.⁶ Briefly, it may be said, the workers in science were grouped in twelve general divisions as follows: Anatomy, anthropology, botany, chemistry, geology, mathematics, pathology, physics, physiology, psychology and zoology. The workers in each science were arranged in an order of merit by ten leading men in each of those sciences. The average position assigned each man, together with the probable error, was computed. Thus each man's position with the reliability of the figure describing his position was determined, and a thousand of the leading men of science were selected as a group for study. Two selections were made; the first in 1903, the second in 1910. The lists varied somewhat in composition due to deaths, changes of position within the group, removal to a foreign country and the like.⁷ The positions attained were not published, that

⁵ Since the above was written the psychologist, James Rowland Angell, has become a member of the National Academy of Sciences and the president of Yale University. The question becomes less pertinent but the case more dramatic.

⁶ J. McKeen Cattell, "American Men of Science," appendix, second edition, 1910.

⁷ A third selection has now been made and will furnish material for a continuation of this study. See "American Men of Science," third edition, J. McKeen Cattell and Dean R. Brimhall, 1921.

information being confidential, but the names of those achieving a position in either selection were marked with an asterisk in the handbook in which they were published. They are referred to in this study as the starred group.

The members of the starred group were asked to report among other data the names of relatives as follows:

Relatives who have done scientific work with designation of relationship and direction of work.

Relatives (with designation of relationship and direction of work) sufficient to warrant inclusion in a book such as "Who's Who," say among the first twenty thousand of a hundred million population.

Relatives (with designation of relationship and direction of work) who have done scientific work or work of distinction in other directions.

Professor Cattell, to whom sole credit is due for gathering the original data, writes concerning requests and replies:

Of one thousand one hundred and fifty-four scientific men from whom information in regard to their families was requested 1,036 replied and 118 did not. Of the replies 16 were blank, sometimes accompanied by the explanation that the information was not readily attainable or the like, 7 were to the effect that the information would be sent later or the like, 13 were received too late, 25 were very imperfect, 975 were usable and in most cases complete. This is an unusually full reply to a questionnaire. For example, in answer to an inquiry in regard to noteworthy relatives addressed to 467 fellows of the Royal Society, Sir Francis Galton received 207 useful replies, and the completely available returns "scarcely exceeded 100."⁸

Following a thorough investigation of that part of the data concerning relatives, in an attempt to supplement and correct them by the use of biographical and genealogical handbooks, the writer sent 186 letters to as many of the men of science, with a report of what had been found in the way of additional information, and asked for corrections and additions. Second and third requests were sometimes sent and in some cases a personal visit to the man of science or near relative was made. As a result the number of usable replies for this study proved to be 956.

⁸ "Families of American Men of Science," *Popular Science Monthly*, May, 1915.

Of these 956 records 22 were incomplete in the case of relatives more remote than parents, children, brothers and sisters. Twenty-three were incomplete in kinships more remote than those mentioned. Fully half of the replies of those found to have distinguished relatives were originally incomplete either in names or designation of relationship of names or both. The brother relationship, where it would be supposed complete information would be available, had 84 cases in the original data. This number was raised to nearly 150 through consultation of the handbooks mentioned below. Not more than 25 of those added were found to have first biographical mention at a date later than that of the request for information.

It is unlikely that the ten per cent. who failed to reply did so because of lack of relatives to report; it is unlikely, because that information was a relatively small part of the total requested. Two hundred and fifty-six, or about one fourth of the number replying, were found to have relatives of distinction or relatives who were scientific men; since the other three fourths replied, though they had no relatives to report, it seems reasonable that those who did not reply did not represent a select group. This is further shown to be the case in the number of cross relationships between the two groups. There are found to be brother and cousin relationships that were reported by some of those replying that would have been reported if the others had replied.

The objective criterion used is biographical inclusion in one or more of the three following handbooks: "American Men of Science," "Who's Who in America," "Appleton's Cyclopedia of American Biography." Both editions of "American Men of Science," that is, the editions of 1903 and 1910, were consulted, and biographies found in either were counted. Those found in the original edition of "Appleton's Cyclopedia," published in 1887-88, together with the appendix of 1900 and all ten volumes of "Who's Who in America," covering the pe-

riod from 1910 to 1918, were also included. The first edition of "American Men of Science" contains more than 4,000 men of science, of entire North America, the second edition about 5,500 names. "Appleton's Cyclopedia of American Biography (1887-88)" contains "above 15,000 prominent native and adopted citizens of the United States, including living persons, from the earliest settlement of the country." In the appendix of 1899-00 "will be found nearly 2,000 notices of Americans who won renown in the war with Spain . . . and of persons of the New World who have become prominent in the peaceful activities of life during the decade," between the appearance of the two publications. The ten volumes of "Who's Who in America" contain 36,915 biographical sketches. The first volume contains 8,602 biographies, while Volume 10 has 22,968. It is evident that the three publications have varying standards of selection, and it becomes necessary to get some statement of the degree of fineness of selection represented by each.

If the reader doubts the validity of any one of the three measures he may disregard those found in that handbook because the lists of names and tables are arranged to that end. That there are biographies of persons included that are out of place is likely and that omissions of others quite deserving occur is also likely, but inclusion represents unusual performance that is a reality.

There is given below the biographical account of one of the persons in the study as it is given in the three different handbooks. Besides adding reality to the data in the lists it will afford a comparison of the characteristic methods employed by the editors of the different publications. The accounts give some idea of the interesting and voluminous records that would be necessary if no more than a brief history of each individual were given. The histories of the men of science and their relatives, if abbreviated in the most careful manner, would make a fair-sized volume. One need only imagine the size of the volume necessary to give an account of the unusual per-

formance of an equal number of people taken at random to see the difference.

BIOGRAPHICAL ACCOUNT OF EDWARD CHARLES PICKERING, AMERICAN
MEN OF SCIENCE, 1910

Pickering, Prof. Edward C(harles), Harvard College Observatory, Cambridge, Mass. * *Astronomy, Astrophysics*. Boston, Mass, July 19, 46. B.S, Harvard, 65, A.M, 80, LL.D, 03; California, 86; Michigan, 87; Sc.D, Victoria (England), 00; LL.D, Chicago, 01; Ph.D, Heidelberg, 03; LL.D, Pennsylvania, 06. Instr. math, Lawrence Sci. Sch, Harvard, 65-67; *prof.* physics, Mass. Inst. Tech, 67-77; *astron. and director, Harvard Col. Observatory*, 77- Bruce Gold Medal, Pacific Astron. Soc; Rumford, Draper, Bruce, two Royal Astron. Soc. and other medals. Nat. Acad; F.A.A. (v. pres, 77); Astron. and Astrophys. Soc. (pres, 06-08); Philos. Soc. (v. pres, 09); fel. Am. Acad; Wash. Acad; hon. mem. N. Y. Acad; cor. mem. Berlin Acad; Soc. astron. de France; Inst. de France; Royal Soc. Upsala; Soc. Lynceorum Nova; St. Petersburg Imp. Acad; Societies of Cherbourg, Palermo, etc. Stellar photometry and spectroscopy.

ACCOUNT GIVEN IN WHO'S WHO IN AMERICA, VOL. 6, 1910-11

Pickering, Edward Charles, astronomer; b. Boston, July 19, 1846. s. Edward and Charlotte (Hammond) P; brother of William Henry P. (*q.v.*); ed. Boston Latin School; S.B, Lawrence Scientific Sch. (Harvard), 1865 (hon. A.M., 1880; LL.D., univs. of Cal., 1886, Mich., 1887, Chicago, 1901, Harvard, 1903, Pa., 1906; Ph.D., Heidelberg, 1903; D.Sc., Victoria U., Eng., 1900; m. Lizzie Wadsworth, d. Jared Sparks, Mar. 9, 1874. Instr. mathematics, Lawrence Scientific Sch., 1865-7; Thayer *prof.* physics, Mass. Inst. Tech., 1867-76; *prof.* astronomy and dir. Harvard Coll. Obs. since 1876. Established 1st physical lab. in U. S.; under his direction, invested capital and income of the observatory has increased fourfold. Study of light and spectra of the stars have been spl. features of his work; devised meridian photometer and made 1,400,000 measures of the light of the stars with it. By establishing an auxiliary sta. in Arequipa, Peru, Southern stars are also observed, extending the work from pole to pole, in which 200,000 photographs are included. Accompanied Nautical Almanac expdn. to observe total eclipse of sun, Aug. 7, 1869; mem. U. S. Coast Survey expdn. to Xeres, Spain, Dec. 22, 1870. Awarded Henry Draper medal for work on astron. physics; gold medals, Rumford, 1891, Bruce, 1908, Royal Astron. Soc., 1886, 1901. Mem. Nat. Acad. Sciences; hon. mem. of Socs. at Mexico, Cherbourg, Liverpool, Toronto, Upsala and Lund; mem. Royal Astron. Soc., Royal Instn. Acaad. dei Lincei, Royal Prussian, and Royal Irish socs., Royal Soc. of London, Institute de France, Imperial Acad., St. Petersburg; pres. Astron. and Astrophys. Soc.

America, 1906-9; fellow Am. Acad. Arts and Sciences; founder and 1st pres. Appalachian Mountain Club; mem. Century Assn., New York. *Author*: Elements of Physical Manipulation, and 60 volumes of annals and other publications of Harvard Coll. Observatory. *Address*: Harvard Observatory, Cambridge, Mass.

ACCOUNT GIVEN IN APPLETON'S CYCLOPEDIA OF AMERICAN
BIOGRAPHY, 1887-8

Pickering, Edward Charles, astronomer, b. in Boston, Mass., 19 July, 1846, was graduated in civil engineering course at the Lawrence scientific school of Harvard in 1865. During the following year he was called to the Massachusetts institute of technology as assistant director of physics, of which branch he held the full professorship from 1868 till 1877. Prof. Pickering devised plans for the physical laboratory of the institution, and introduced the experimental method of teaching physics at a time when that mode of instruction had not been adopted elsewhere. His scientific work of these years consisted largely of researches in physics, notably investigations on the polarization of light and the laws of its reflection and dispersion. He also described a new form of spectrum telescope, and invented in 1870 a telephone receiver, which he publicly exhibited. He observed the total eclipse of the sun on 7 Aug., 1869, with the party that was sent out by the Nautical almanac office, at Mt. Pleasant, Iowa, and was a member of the U. S. coast survey expedition to Xeres, Spain, to observe that of 22 Dec., 1870, having, on that occasion, charge of the polariscope. In 1876 he was appointed professor of astronomy and geodesy, and director of the observatory at Harvard, and under his management this observatory has become one of the foremost in the United States. More than twenty assistants now take part in investigations under his direction and the invested funds of the observatory have increased from \$176,000 to \$654,000 during his administration. His principal work since he accepted this appointment has been the determination of the relative brightness of the stars, which is accomplished by the means of a meridian photometer, an instrument specially devised for this purpose, and he has prepared a catalog giving the brightness of over 4,000 stars. Since 1878 he has also made photometer measurements of Jupiter's satellites while they are undergoing eclipse, and of the satellites of Mars and other faint objects. On the death of Henry Draper (q.v.) his widow requested Prof. Pickering to continue important researches on the application of photography to astronomy, as a Henry Draper memorial, and the study of the spectra of the stars has been undertaken on a scale that was never before attempted. A fund of \$250,000, left by Uriah A. Boyden (q.v.) to the observatory, has been utilized for the special study of the advantages of very elevated observing stations. Prof. Pickering has also devoted attention to such objects as mountain surveying, the height and velocity of clouds, papers on which he

has contributed to the Appalachian Club, of which he was president in 1877, and again in 1882. He is an associate of the Royal astronomical society of London, from which in 1886 he received its gold medal for photometric researches, and besides membership in other scientific societies in the United States and Europe he was elected in 1873 to the National academy of sciences, by which body he was further honored in 1887 with the award of the Henry Draper medal for his work on astronomical physics. In 1876 he was elected a vice-president of the American association for the advancement of science, and presented his retiring address before the section of mathematics and physics at the Nashville meeting. In addition to his many papers which number about 100, he prepared "Reports on the Department of Physics," for the Massachusetts institute of technology, and the "Annual Reports of the Director of the Astronomical Observatory," likewise editing the "Annals of the Astronomical Observatory of Harvard College." He has also edited with notes "The Theory of Color in Relation to Art and Art Industry," by Dr. William von Bezold (Boston, 1876), and he is the author of "Elements of Physical Manipulation" (2 parts, Boston, 1873-6).

The raw material of the investigation is found below in the lists of men of science and their relatives. Statistical treatment of these data will follow. They are arranged so that any competent observer can test their validity. While great effort has been made to have the details reliable, it is possible that mistakes may be found in the designation of relationship, but it is thought that such mistakes are few if any.

THE MEN OF SCIENCE AND THEIR NEAR RELATIVES OF DISTINCTION

The names of the men of science and their near relatives of distinction are given at the left of the page. The name of the man of science comes first and is followed by a short dash. The names of the relatives follow and are preceded by the letter or letters which tell the relationship. The first name, for example, is Allis, Edward Phelps; he has a cousin (F'SiS, a father's sister's son), Callahan, Henry White, whose work is in education. The biography of this relative is found in "Who's Who in America." When the name of a relative is printed in small capitals it shows that the person is known for work

in science. The direction of the performance of the relatives is given at the right of the name. The handbook or books containing his biographical account are shown by the abbreviations at the right. These abbreviations are to be understood as follows: A.M.S, American Men of Science (if preceded by an asterisk the person is in the starred group of men of science); W.W, Who's Who in America; A.C, Appleton's Cyclopedia of American Biography.

Any degree of relationship can be conveniently and accurately described by one, or a combination of two or more, of the following seven letters: S for son, D for daughter, B for brother, Si for sister, F for father, M for mother. Thus, paternal grandfather can be written as FF, meaning father's father, maternal grandfather, MF, meaning mother's father, FBS meaning first cousin or father's brother's son, etc. These symbols precede the name and show the kinship of the person to the man of science.

The men of science are arranged according to the science in which they were recorded as obtaining a place in the starred group. The groups are arranged alphabetically, beginning with the anatomists and closing with the zoologists.

Starred anatomists and near relatives of distinction	Direction of performance	Handbooks containing biographical accounts of relatives
<i>Anatomists</i>		
Allis, Edward Phelps—		
FSiS Callahan, Henry White	Education	W.W.
Bardeen, Charles Russell—		
F Bardeen, Charles William	Education	W.W.
Bensley, Robert Russell—		
B Bensley, Benjamin Arthur	Zoology	A.M.S.
Dwight, Thomas—		
MB WARREN, JONATHAN MASON	Surgery	A.C.
MF WARREN, JOHN COLLINS	Surgery	A.C.
MBS WARREN, JOHN COLLINS	Surgery	*A.M.S; W.W. A.C.
FBS Dwight, Wilder	Warfare	A.C.
FBS Dwight, William	Warfare	W.W.

Greenman, Milton Jay—

FBS GREENMAN, JESSE MORE	Botany	*A.M.S; W.W.
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Meyer, Arthur William—

B Meyer, Balthassar Henry	Polit. econ.	W.W.
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Spitzka, Edward Anthony—

F SPITZKA, EDWARD A.	Neurology	A.M.S; A.C.
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Anthropologists

Dorsey, George Amos—

B DORSEY, CLARENCE W.	Soil physics	W.W.
B DORSEY, HERBERT GROVE	Physics	A.M.S.

Farrand, Livingston—

B Farrand, Max	History	W.W.
B Farrand, Wilson	Education	W.W.

Hough, Walter—

FBS HOUGH, THEODORE	Physiology	*A.M.S; W.W.
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Astronomers

Doolittle, Charles Leander—

S DOOLITTLE, ERIC	Astronomy	*A.M.S; W.W.
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Doolittle, Eric—

F DOOLITTLE, CHARLES L.	Astronomy	*A.M.S; W.W.
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Frost, Edwin Brant—

B FROST, GILMAN DUBOIS	Anatomy	A.M.S.
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Lowell, Percival—

B Lowell, Abbott Lawrence	Education	W.W.
Si Lowell, Amy	Poetry	W.W.
MF Lawrence, Abbot	Diplomacy	A.C.
FSiD Cabot, Ella Lowell Lyman	Education	W.W.
MSiS ROTCH, ABBOTT LAWRENCE	Physics	*A.M.S; W.W.
MSiS Rotch, Arthur	Architecture	A.C.

Pickering, Edward Charles—

B PICKERING, WILLIAM H.	Astronomy	*A.M.S; W.W; A.C.
FB PICKERING, CHARLES	Ethnol; Bot.	A.C.

Pickering, William Henry—

B PICKERING, EDWARD C.	Astronomy	*A.M.S.
FB PICKERING, CHARLES	Ethnol; Bot.	A.C.

Pritchett, Henry Smith—

F Pritchett, Car Waller	Ministry; Educ.	W.W.
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Searle, Arthur—	Astron; Religion	A.M.S; W.W;
B SEARLE, GEORGE MARY		A.C.
Stone, Ormond—	Journ; Finance	
B Stone, Melville Elijah		W.W; A.C.
Wright, William Hammond—		
M Wright, Johanna Maynard	Organization	W.W.

Botanists

Beal, William James—		
MSiS STEERS, JOSEPH BEAL	Zoology	A.M.S; W.W.
Bessey, Ernst Athern—		
F BESSEY, CHARLES EDWIN	Botany	*A.M.S; W.W.
Bessey, Charles Edwin—		
S BESSEY, ERNST ATHERN	Botany	*A.M.S; W.W.
Blakeslee, Albert Francis—		
B Blakeslee, George Hubbard	History	W.W.
F Blakeslee, Francis Durbin	Ministry	W.W.
Bray, William—		
MBS or FSiS FOSTER, LUTHER	Botany	W.W.
Campbell, Douglas Houghton—		
B CAMPBELL, EDWARD DEM.	Chemistry	*A.M.S; W.W.
B Campbell, Henry Munroe	Law	W.W.
F Campbell, James V.	Law	A.C.
Coker, William Chambers—		
F Coker, James Lide	Manufacturing	W.W.
FBS COKER, ROBERT IRWIN	Zoology	A.M.S; W.W.
Coulter, John Merle—		
B COULTER, STANLEY	Botany	*A.M.S; W.W.
S COULTER, JOHN GAYLORD	Botany	A.M.S.
FBS COULTER, SAMUEL MONDS	Botany	A.M.S.
Coulter, Stanley—		
B COULTER, JOHN MERLE	Botany	*A.M.S; W.W;
		A.C.
BS COULTER, JOHN GAYLORD	Botany	A.M.S.
FBS COULTER, SAMUEL MONDS	Botany	A.M.S.
Coville, Fred Vernon—		
B COVILLE, LUZERNE	Medicine	A.M.S.
Davis, Bradley Moore—		
FSiS WOOD, ROBERT WILLIAMS	Physics	*A.M.S; W.W.

Duggar, Benjamin Minge—

B	DUGGAR, JOHN FREDERIC	Agronomy	A.M.S; W.W.
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Earle, Franklin Sumner—

Si	Horne, Mary Tracy Earle	Fiction	W.W.
F	EARLE, PARKER	Horticulture	A.C.

Fernald, Merritt Lyndon—

B	FERNALD, ROBERT H.	Mech. eng.	A.M.S; W.W.
F	FERNALD, MERRITT C.	Educ; Physics; Math.	A.M.S; W.W.

Greenman, Jesse More—

FBS	GREENMAN, MILTON JAY	Anatomy	*A.M.S; W.W.
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Halstead, Byron David—

SiS	FAIRCHILD, DAVID G.	Botany	*A.M.S; W.W.
SiS	Fairchild, Edwin Milton	Education	W.W.

Kearney, Thomas H.—

MB	Miner, Charles Wright	Warfare	W.W.
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Macbride, Thomas Huston—

FSiS	Sterrett, James M.	Ministry; Hist.	W.W.
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Pinchot, Gifford—

B	Pinchot, Amos	Law; Politics	W.W.
F	Pinchot, James W.	Trade	W.W.
MF	Eno, Amos R.	Finance	A.C.

Pound, Roscoe—

Si	Pound, Louise	Philology	W.W.
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Robinson, Benjamin Lincoln—

B	Robinson, James H.	History	W.W.
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Shull, George Harrison—

B	SHULL, CHARLES ALBERT	Zoology	A.M.S.
B	Scholl, John W.	Literature	W.W.

Chemists

Acheson, Edward Goodrich—

FB	Acheson, Marcus Wilson	Law	W.W.
FBS	Acheson, Alexander M.	Civil Eng.	W.W.
FBS	Acheson, Alexander W.	Med; Politics	W.W.
FBS	Acheson, Ernest Francis	Journal; Politics	W.W.
FBS	Acheson, Marcus W. Jr.	Law	W.W.
FSiS	Brownson, Marcus A.	Ministry	W.W.
FSiD	Brownson, Mary Wilson	Literature; Math.	W.W.

Bancroft, Wilder Dwight—

FF	Bancroft, George	History	A.C.
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Blair, Andrew Alexander—			
F	Blair, Francis Preston	Warfare; Politics	A.C.
FF	Blair, Francis Preston	Journal; Politics	A.C.
Burgess, Charles Frederick—			
B	Burgess, George H.	Railway Eng.	W.W.
Campbell, Edward DeMille—			
B	CAMPBELL, DOUGLAS H.	Botany	*A.M.S; W.W.
B	Campbell, Henry Munroe	Law	W.W.
F	Campbell, James V.	Law	A.C.
Chatard, Thomas Marean—			
B	Chatard, Francis Silas	Educ; Ministry; Med.	W.W; A.C.
FB	Chatard, Frederick	Warfare	A.C.
Crafts, James Mason—			
MF	Mason, Jeremiah	Law	A.C.
Dabney, Charles William—			
F	Dabney, Robert Lewis	Educ; Ministry	A.C.
Doremus, Charles Avery—			
F	DOREMUS, ROBERT O.	Chemistry	A.M.S; W.W; A.C.
FM	Doremus, S. P. (Haines)	Philanthropy	A.C.
Dunnington, Francis Perry—			
MB	Keener, John C.	Ministry	W.W; A.C.
Franklin, Edward Curtis—			
B	FRANKLIN, WILLIAM S.	Physics	*A.M.S; W.W.
Freer, Paul Casper—			
B	Freer, Frederick W.	Art (Painting)	W.W.
B	FREER, OTTO TIGER	Laryngology	W.W.
Hilgard, Eugene Woldemar—			
B	HILGARD, JULIUS	Math; Geodesy	A.C.
B	HILGARD, THEODORE C.	Biology	A.C.
F	HILGARD, THEODORE E.	Law	A.C.
SiS	TITTMAN, OTTO HILGARD	Geodesy	A.M.S; W.W.
Jackson, Charles Loring—			
FSi	Lowell, Anna C. J.	Education	A.C.
FF	Jackson, Patrick Tracy	Manufacturing	A.C.
MF	Loring, Charles Greely	Insurance; Law	W.W; A.C.
FSiS	CABOT, ARTHUR TRACY	Surgery	W.W.
MBS	Loring, William Caleb	Law	W.W.
FSiS	Lowell, C. R.	Warfare	A.C.
Lewis, Gilbert Newton—			
FB	Lewis, Homer Pierce	Education	W.W.

Lloyd, John Uri—

B	LLOYD, CURTIS GATES	Botany	A.C.
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Loeb, Morris—

B	Loeb, James	Finance; Archeol.	W.W.
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More, Richard Bishop—

F	Moore, William Thomas	Ministry; Editing	W.W.
MF	Bishop, Richard Moore	Politics; Trade	A.C.

Morely, Edward Williams—

B	Moreley, John Henry	Ministry; Educ.	W.W.
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Munroe, Charles Edward—

FBS	Munroe, James Phinney	Mfg; Writing	W.W.
FBS	Munroe, Kirk	Fiction; Journal	W.W.

Norris, James Flack—

B	NORRIS, RICHARD C.	Surgery	W.W.
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Norton, Thomas Herbert—

MB	HORSFORD, EBEN NORTON	Chemistry	A.C.
MF	Horsford, Jerediah	Warfare	A.C.
MBD	HORSFORD, CORNELIA	Archeology	W.W.
FBS	NORTON, LEWIS MILLS	Chemistry	A.C.

Noyes, William Albert—

Si	Davidson, Hanna M. N.	Education; Lit.	A.C.
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Orndorf, William Ridgely—

MF	Ridgely, James Lot	Law	A.C.
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Osborne, Thomas Burr—

MB	BLAKE, ELI WHITNEY	Chem; Physics	A.C.
MF	Blake, Eli Whitney	Invention; Mfg.	A.C.

Palmer, Chase—

FSiS	Harris, George	Ministry; Lit.	W.W.
MBS	Chase, George	Educ; Law	W.W.

Pellew, Charles Ernest—

F	Pellew, Henry Edward	Philanthropy	W.W.
MB	Jay, John	Diplomacy	A.C.
MF	Jay, William	Law	A.C.
MBS	Jay, William	Law	W.W.

Pond, George Gilbert—

$\frac{1}{2}$ B	POND, FRANCIS JONES	Chemistry	A.M.S.
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Reese, Charles Lee—

B	Reese, Frederick Focke	Ministry	W.W.
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Richards, Theodore William—

B	RICHARDS, HERBERT M.	Botany	*A.M.S; W.W.
F	Richards, William Trost	Art (Painting)	W.W; A.C.

Sadtler, Samuel Philip—

F	Sadtler, Benjamin	Ministry	A.C.
MB	Schmucker, B. Melancton	Ministry	A.C.
MB	Schmucker, Samuel M.	Writing	A.C.
MB	Schmucker, Samuel D.	Law	W.W.
MF	Schmucker, Samuel S.	Educ; Theol.	A.C.
MBS	SCHMUCKER, SAMUEL C.	Botany	A.M.S; W.W.

Sanger, Charles Robert—

F	Sanger, George P.	Law	A.C.
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Saunders, Arthur Percy—

B	SAUNDERS, CHARLES E.	Chemistry	A.M.S.
B	SAUNDERS, FREDERICK A.	Physics	*A.M.S; W.W.
B	SAUNDERS, WILLIAM E.	Ornith; Bot.	A.M.S.
F	SAUNDERS, WILLIAM	Horticulture	A.M.S.

Sherman, Henry Clapp—

B	SHERMAN, FRANKLIN, JR.,	Entomology	A.M.S.
FBS	Sherman, Frank D.	Architect; Poetry	W.W.

Shimer, Porter William—

FBS	SHIMER, HERVEY W.	Geology	A.M.S; W.W.
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Smith, Edgar Fahs—

B	SMITH, ALLEN JOHN	Pathology	A.M.S; W.W.
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Stieglitz, Julius Oscar—

B	Stieglitz, Alfred	Photog; Chem.	W.W.
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Stillman, John Maxon—

½B	STILLMAN, STANLEY	Surgery	W.W.
FB	Stillman, Thomas Bliss	Manufacturing	A.C.
FB	Stillman, William James	History; Journal	W.W; A.C.
FBS	STILLMAN, THOMAS B.	Chemistry	*A.M.S; W.W.

Stillman, Thomas Bliss—

FB	Stillman, Thomas Bliss	Manufacturing	A.C.
FB	Stillman, William James	History; Journal	W.W; A.C.
FBS	STILLMAN, JOHN MAXON	Chemistry	*A.M.S; W.W.
FBS	STILLMAN, STANLEY	Surgery	W.W.

Tuckerman, Alfred—

B	Tuckerman, Bayard	History	W.W.
MB	Gibbs, Alfred	Warfare	A.C.
MB	Gibbs, George	Antiquarianism	A.C.
MB	GIBBS, OLIVER WOLCOTT	Chemistry	*A.M.S; W.W; A.C.
FF	Tuckerman, Joseph	Ministry	A.C.
MF	GIBBS, GEORGE	Geology	A.C.
FSiS	BECKER, GEORGE F.	Geology	*A.M.S; W.W.

VanSlyke, Lucius Lincoln—

S	VANSLYKE, DONALD D.	Chemistry	A.M.S.
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Venable, Francis Preston—

F	VENABLE, CHARLES S.	Astronomy	W.W; A.C.
MF	McDowell, James	Politics	A.C.

Waller, Elwyn—

B	Waller, Frank	Architecture	W.W; A.C.
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Geologists

Ashley, George Hall—

B	Ashley, Roscoe Lewis	History; Econ.	W.W.
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Becker, George Ferdinand—

MF	Tuckerman, Joseph	Ministry	A.C.
MBS	TUCKERMAN, ALFRED	Chemistry	*A.M.S; W.W.
MSiS	Tuckerman, Bayard	Biography; Hist.	W.W.

Brooks, Alfred Hulse—

F	BROOKS, THOMAS B.	Geology	A.C.
Si	Paige, Hildegard B.	Fiction	W.W.

Chamberlin, Thomas Corwin—

S	CHAMBERLIN, ROLLIN T.	Geology	A.M.S; W.W.
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Clarke, John Mason—

B	Clarke, Lorenzo Mason	Ministry	W.W.
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Dana, Edward Salisbury—

F	DANA, JAMES DWIGHT	Geology	A.C.
MB	SILLIMAN, BENJAMIN JR.	Chemistry	A.C.
MF	SILLIMAN, BENJAMIN	Chem; Geol.	A.C.

Davis, William Morris—

MF	Mott, James	Philanthropy	A.C.
MM	Mott, Lucretia	Ministry (Quaker)	A.C.

Farrington, Oliver Cummings—

		Journalism;	W.W.
B	Farrington, Wallace R.	Hist.	
B	FARRINGTON, EDWARD H.	Chemistry	W.W.

Gilbert, Grove Karl—

F	Gilbert, Grove Sheldon	Art	A.C.
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Grant, Ulysses Sherman—

F	Grant, Lewis Addison	Law; Warfare	W.W; A.C.
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Hague, Arnold—

B	HAGUE, JAMES DUNCAN	Geology	A.M.S; W.W; A.C.
F	Hague, William	Ministry	A.C.

Harris, Gilbert Dennison—

B	HARRIS, ROLLIN ARTHUR	Geodesy	A.M.S; W.W.
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Hayes, Charles Willard—			
Si	HAYES, ELLEN	Mathematics	A.M.S.
Hitchcock, Charles Henry—			
F	HITCHCOCK, EDWARD	Geol; Educ.	A.C.
B	HITCHCOCK, EDWARD	Hygiene	A.M.S; W.W; A.C.
BS	HITCHCOCK, EDWARD, JR.	Hygiene	A.M.S; W.W.
Irving, John Duer—			
F	IRVING, ROLAND DUER	Geology	A.C.
Jaggar, Thomas Augustus, Jr.—			
F	Jaggar, Thomas A.	Ministry	W.W; A.C.
Keith, Arthur—			
	MSiS GALE, HOYT STODDARD	Geology	A.M.S.
Mathews, Edward Bennett—			
B	Mathews, Shailer	Educ; Theol.	W.W.
Merriam, John Campbell—			
B	Merriam, Charles E.	Politics; Hist.	W.W.
Merrill, George Perkins—			
B	MERRILL, LUCIUS H.	Chemistry	A.M.S; W.W.
Penrose, Richard Alex. Fullerton—			
B	Penrose, Boies	Politics; Law	W.W.
B	PENROSE, CHARLES B.	Surg; Physies	A.M.S; W.W.
B	Penrose, Spencer	Eng; Finance	W.W.
F	PENROSE, RICHARD A. F.	Surgery	A.M.S; W.W; A.C.
FB	Penrose, Clement B.	Law	W.W.
FF	Penrose, Charles B.	Law	A.C.
FBS	Penrose, Stephen B. L.	Educ; Philos.	W.W.
Pumpelly, Raphael—			
D	Smyth, Margarette P.	Art (Painting)	W.W.
M	Pumpelly, Mary Weller	Poetry	A.C.
Rice, William North—			
S	RICE, EDWARD LORANUS	Zoology	*A.M.S; W.W.
Scott, William Berryman—			
B	SCOTT, HUGH LENNOX	Warfare; Anthrop.	W.W.
MB	Hodge, Archibald Alex.	Theology	A.C.
MF	Hodge, Charles	Theology	A.C.
Smith, James Perrin—			
B	Smith, Charles Forster	Philology	W.W.
Stevenson, John James—			
MB	Willson, James McLeod	Philol; Theol.	A.C.
MF	Willson, James Renwick	Philol; Theol.	A.C.
MBS	Willson, David Burt	Philol; Theol.	W.W; A.C.

Taylor, Frank Bensley—			
F	Stewart, Robert	Politics; Law	W.W.
Vaughn, Thomas Wayland—			
FBS	Vaughn, Horace Worth	Politics; Law	W.W.
Weed, Walter Harvey—			
F	Weed, Samuel Richards	Finance; Lit.	W.W.
Weller, Stewart—			
MB	Marran, J. T.	Law	W.W.
White, David—			
MSiS	Kent, Charles Foster	Hist; Archeol.	W.W.
Willis, Bailey—			
F	Willis, Nathaniel P.	Poetry	A.C.
FB	Willis, Richard Storrs	Music	A.C.
Winchell, Alexander Newton—			
B	WINCHELL, HORACE V.	Geology	A.M.S; W.W.
F	WINCHELL, NEWTON H.	Geol; Archeol.	*A.M.S; W.W; A.C.
FB	WINCHELL, ALEXANDER	Geology	A.C.
FB	Winchell, Samuel R.	Edu; Journalism	W.W.
Winchell, Newton Horace—			
B	WINCHELL, ALEXANDER	Geology	A.C.
B	Winchell, Samuel R.	Edu; Journalism	W.W.
S	WINCHELL, ALEX. N.	Geology	*A.M.S; W.W.
S	WINCHELL, HORACE V.	Geology	A.M.S; W.W.
FBS	Winchell, Benj. La Fon	Ry. Management	W.W.
FB	Winchell, James M.	Ministry	A.C.
Wright, Frederic Eugene—			
B	WRIGHT, CHARLES WILL	Geology	A.M.S.

Mathematicians

Birkoff, George David—			
MB	Droppers, Garrett	Polit. Econ.	W.W.
Coolidge, Julian Lowell—			
B	Coolidge, Archibald C.	History	W.W.
B	Coolidge, John Gardiner	Diplomacy	W.W.
B	Coolidge, J. Randolph Jr.	Architecture	W.W.
FB	Coolidge, Jefferson	Diplomacy	W.W; A.C.
FBS	Coolidge, T. Jefferson Jr.	Finance	W.W.
Fine, Henry Burchard—			
FF	Fine, John	Politics; Law	A.C.

Franklin, Fabian—			
MB	Heilprin, Michael	History; Sociol.	A.C.
MF	Heilprin, Phineas M.	Semitics	A.C.
MBS	HEILPRIN, ANGELO	Geology	*A.M.S; W.W; A.C.
MBS	Heilprin, Louis	Philology	W.W; A.C.
Halsted, George Bruce—			
F	Halsted, Oliver Spencer	Politics	A.C.
FF	Halsted, Oliver Spencer	Philology	A.C.
Johnson, William Woolsey—			
B	Johnson, Charles Fred.	Philology; Math.	W.W.
McClintock, Emory—			
F	McClintock, John	Educ; Ministry	A.C.
Moore, Eliakim Hastings—			
F	Moore, David Hastings	Educ; Ministry	W.W.
Pierce, Charles Santiago Sanders—			
B	Peirce, Herbert H. D.	Diplomacy	W.W.
B	PEIRCE, JAMES MILLS	Math; Educ.	*A.M.S; W.W; A.C.
F	PEIRCE, BENJAMIN	Mathematics	A.C.
FB	PEIRCE, CHARLES HENRY	Chem; Med.	A.C.
FF	Peirce, Benjamin	Library (Harvard)	A.C.
MF	Mills, Elijah Hunt	Politics	A.C.
Roe, Edward Drake Jr—			
FB	Roe, Francis Asbury	Warfare	W.W; A.C.
Slichter, Charles Summer—			
BS	SLICHTER, WALTER I.	Elec. Eng.	A.M.S; W.W.
Van Vleck, Edward Burr—			
F	VAN VLECK, JOHN M.	Astron; Math.	A.M.S; W.W; A.C.
Veblen, Oswald—			
F	VEBLER, ANDREW A.	Math; Physics	A.M.S; W.W.
FB	Veblen, Thorstein B.	Economics	W.W.
Wilson, Edwin Bidwell—			
FB	Wilson, Frank E.	Politics; Law	W.W.

Pathologists

Biggs, Herman Michael—			
FBS	BIGGS, GEORGE PATTEN	Pathology	A.M.S.
FBS	BLUMER, GEORGE ALDER	Neurol; Med.	W.W.
Blumer, George—			

Cabot, Richard Clarke—

FBS CABOT, ARTHUR TRACY	Med; Surg.	W.W.
FBS CABOT, GODFREY L.	Chemistry	W.W.

Christian, Henry Asbury—

FBS Christian, George L.	Politics; Lit; War	W.W.
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Cushing, Harvey Williams—

B CUSHING, HENRY	Geology	A.M.S; W.W.
B Cushing, William E.	Law	W.W.
MSiS CREHORE, ALBERT C.	Physics; Eng.	*A.M.S; W.W.
MSiS CREHORE, WILLIAM W.	Mech. Eng.	W.W.

Dana, Charles Loomis—

B Dana, John Cotton	Library	W.W.
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Dock, George—

Si DOCK, LAVINA L.	Medicine	W.W.
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Ernst, Harold Clarence—

B Ernest, George Alex.	Law	W.W.
B ERNST, OSWALD H.	Astron; War; Eng.	W.W.
MF OTIS, GEORGE ALEX.	Surgery	A.C.

Flexner, Simon—

B Flexner, Abraham	Education	W.W.
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Hurd, Henry Mills—

½B HURD, ARTHUR W.	Psychiatry	W.W.
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Loeb, Leo—

B LOEB, JACQUES	Zoology	*A.M.S; W.W.
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MacCallum, William George—

B MACCALLUM, JOHN B.	Anatomy	*A.M.S; W.W.
F MACCALLUM, GEORGE A.	Ornith; Med.	W.W.

Mitchell, Silas Weir—

S MITCHELL, JOHN K.	Neurology	A.M.S; W.W.
S Mitchell, Langdon E.	Playwriting	W.W.
F MITCHELL, JOHN K.	Chem; Med.	A.C.

Musser, John Herr—

MBS or FSiS Herr, Edwin M.	Elec. Eng.	W.W.
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Park, William Hallock—

MF Hallock, William S.	Editing; Ministry	A.C.
MSiS Johnson, William H.	Ministry; Philos.	W.W.

Putnam, James J.—

MF Jackson, James	Clin. Med.	A.C.
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Ravenel, Mazyek Porcher—

FBS	RAVENEL, HENRY W.	Botany	A.C.
MBS	PORCHER, FRANCIS P.	Botany; Chem.	A.C.

Thayer, William Sydney—

B	Thayer, Ezra Ripley	Law	W.W.
F	Thayer, James Bradley	Law	A.C.
MSiS	Simons, Edward	Art (Painting)	W.W.

Warren, John Collins—

F	WARREN, JONATHAN M.	Surg; Med.	A.C.
FF	WARREN, JOHN COLLINS	Surgery	A.C.
FSiS	DWIGHT, THOMAS	Anatomy	*A.M.S; W.W; A.C.

Williams, Herbert Upham—

Si	Williams, Eliz. Sprague	Sociology	W.W.
FSiS	Sprague, Carleton	Finance; Art	W.W.

Welch, William Henry—

FSiS	Cowles, John Guiteau	Finance	W.W.
MBS	Collin, Frederick Welch	Law	W.W.
MBS	Collin, Charles Avery	Law	W.W.

Physicists

Abbe, Cleveland—

B	ABBE, ROBERT	Surg; Physics	A.M.S; W.W.
S	ABBE, CLEVELAND, JR.	Meteorol; Geog.	A.M.S; W.W.
S	ABBE, TRUMAN	Surg; Physiol.	W.W.
FSiS	Smith, Guilford	Finance; Philanth.	W.W.

Abbot, Charles Greeley—

FBS	Abbot, Henry Larcom	Eng; Warfare	A.M.S; W.W.
FBS	Abbot, Edwin Hale	Finance; Law	W.W.

Bauer, Louis Agricola—

B	BAUER, WILLIAM C.	Elec. Eng.	A.M.S; W.W.
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Bell, Alexander Graham—

F	BELL, ALEX. MELVILLE	Physiology	A.M.S; W.W; A.C.
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Bell, Louis—

F	Bell, Louis	Warfare; Chem.	A.C.
FB	Bell, James	Politics; Law	A.C.
FB	BELL, JOHN	Editing; Med.	A.C.
FB	BELL, LUTHER V.	Medicine	A.C.
FB	Bell, Samuel Dana	Law	A.C.
MB	Bouton, John Bell	Editing	A.C.
MF	Bouton, Nathaniel	Ministry	A.C.
FF	Bell, Samuel	Politics; Law	A.C.
FBS	Bell, Samuel Newell	Politics; Law	A.C.

Buckingham, Edgar—

FF	Buckingham, Joseph T.	Editing; Publish.	A.C.
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Crehore, Albert Cushing—

B	CREHORE, WILLIAM W.	Bridge Eng.	W.W.
MSiS	CUSHING, HARVEY W.	Pathology	*A.M.S; W.W.
MSiS	CUSHING, HENRY PLATT	Geology	A.M.S; W.W.
MSiS	Cushing, William E.	Law	W.W.

Davis, Harvey Nathaniel—

F	DAVIS, NATHANIEL F.	Mathematics	A.M.S; W.W.
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Duane, William—

B	Duane, Russel	Law	W.W.
FF	Duane, William	Publishing	A.C.

Franklin, William Suddards—

B	FRANKLIN, EDWARD C.	Chemistry	*A.M.S; W.W.
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Hering, Carl—

B	HERING, RUDOLPH	Hydraulic Eng.	A.M.S.
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Humphreys, William Jackson—

FB	Humphreys, Milton W.	Philology	W.W; A.C.
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Ives, Frederick Eugene—

S	IVES, HERBERT EUGENE	Physics	A.M.S.
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Jackson, Dugald Caleb—

B	JACKSON, JOHN PRICE	Elec. Eng.	W.W.
B	Jackson, William B.	Engineering	W.W.
FSiS	Cravath, Paul Drennan	Law	W.W.

Kent, Norton Adams—

B	Kent, William	Philanthropy	W.W.
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Kimball, Arthur Lalanne—

B	Kimball, A. Redington	Finance	W.W.
MB	Fisher, Samuel Ware	Ministry; Educ.	A.C.
MBS	Fisher, Samuel S., Jr.	Politics; Law	A.C.

Kinsley, Carl—

F	Kinsley, William W.	Math; Theology	W.W.
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Lyman, Theodore—

F	LYMAN, THEODORE	Zoology	A.C.
FF	Lyman, Theodore	Philanthropy	A.C.

Magie, William Francis—

F	Magie, William Jay	Politics; Law	W.W.
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Mann, Charles Reborg—

F	Mann, Charles H.	Inventing; Editing; Ministry	W.W.
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FSi	Miller, Harriet Mann	Ornith; Writing	W.W.
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Mendenhall, Thomas Corwin—			
S	MENDENHALL, C. E.	Physics	*A.M.S; W.W.
Mendenhall, Charles Elwood—			
F	MENDENHALL, T. C.	Physics	*A.M.S; W.W; A.C.
More, Lewis Trenchard—			
B	More, Enoch Anson, Jr.	Fiction	W.W.
B	More, Paul Elmer	Poetry; Editing	W.W.
MF	Elmer, Lucius Q. C.	Politics; Law	A.C.
Northrup, Edwin Fitch—			
B	Northrup, Elliott Judd	Law	W.W.
F	Northrup, Ansel Judd	Law	W.W; A.C.
FB	NORTHROP, WILLIAM P.	Pathology	A.M.S; W.W.
MB	Fitch, Charles Elliott	Editing; Educ.	W.W.
Parson, William Barclay—			
B	PARSONS, HARRY DEB.	Mech. Eng.	A.M.S; W.W.
Rotch, Abbott Lawrence—			
B	Rotch, Arthur	Architecture	A.C.
MF	Lawrence, Abbott	Diplomacy	A.C.
FBS	ROTCH, THOMAS M.	Pediatrics	*A.M.S; W.W.
MSiS	Lowell, Abbott Lawrence	Educ.	W.W.
MSiS	LOWELL, PERCIVAL	Astronomy	*A.M.S; W.W; A.C.
MSiD	Lowell, Amy	Poetry	W.W.
Saunders, Frederick Albert—			
B	SAUNDERS, ARTHUR P.	Chemistry	*A.M.S; W.W.
B	SAUNDERS, CHARLES E.	Chemistry	A.M.S.
B	SAUNDERS, WILLIAM E.	Botany	A.M.S.
F	SAUNDERS, WILLIAM	Horticulture	A.M.S.
Stevens, Walter LeCont—			
MB	LECONTE, JOHN	Physics	A.C.
MB	LECONTE, JOSEPH	Geology	W.W; A.C.
MF	LECONTE, LEWIS	Botany	A.C.
MBS	LECONTE, JOSEPH N.	Mech. Eng.	A.M.S; W.W.
Stewart, Oscar Milton—			
B	STEWART, GEORGE W.	Physics	*A.M.S; W.W.
Stewart, George Walter—			
B	STEWART, OSCAR M.	Physics	*A.M.S; W.W.
Trowbridge, Charles Christopher—			
B	Trowbridge, S. B. P.	Architecture	W.W.
F	TROWBRIDGE, W. P.	Engineering	A.C.

Very, Frank Washington—

FB	Very, Jones	Lit; Ministry	A.C.
FSi	Very, Lydia Louisa A.	Literature	W.W; A.C.

Wead, Charles Dasson—

MB	Kasson, John Adams	Politics	W.W; A.C.
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Whitman, Frank Perkins—

MSiS	Taylor, James Monroe	Educ; Ethics	W.W; A.C.
MSiD	Bissell, Mary Taylor	Medicine	W.W.

Wood, Robert Williams—

MBS	DAVIS, BRADLEY MOORE	Botany	*A.M.S; W.W.
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Wurts, Alexander Jay—

B	Wurts, John	Law	W.W.
MF	JAY, JOHN CLARKSON	Medicine	A.C.

Zeleny, John—

B	ZELENY, ANTHONY	Physics	*A.M.S; W.W.
B	ZELENY, CHARLES	Zoology	*A.M.S; W.W.

Zeleny, Anthony—

B	ZELENY, CHARLES	Zoology	*A.M.S; W.W.
B	ZELENY, JOHN	Physics	*A.M.S; W.W.

Physiologists

Curtis, John Green—

B	Curtis, Edward	Medicine	W.W; A.C.
B	Curtis, Joseph Bridgham	Warfare; Eng.	A.C.
‡B	Curtis, George William	Lit; Publishing	W.W.
BD	Curtis, Constance	Art (Painting)	W.W.
BD	Curtis, Natalie	Music	W.W.

Dawson, Percy Millard—

FB	Dawson, Samuel Edward	Hist; Publishing	A.C.
FSiS	ADAMS, FRANK DAWSON	Geology	A.M.S.

Hare, Hobart Amory—

F	Hare, William Hobart	Ministry	A.C.
FF	Hare, George Enlen	Ministry	A.C.
MF	Howe, Mark A. DeWolfe	Ministry	W.W; A.C.
MBS	Howe, Mark A. DeWolfe	Editing	W.W.

Henderson, Yandell—

MB	YANDELL, DAVID WENDEL	Surgery	A.C.
MF	YANDELL, LUNSFORD	Geology; Med.	A.C.

Hough, Theodore—

FBS	HOUGH, WALTER	Anthropology	*A.M.S; W.W.
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Lee, Frederic Schiller—

B	LEE, LESLIE ALEXANDER	Zool; Geol.	*A.M.S.; W.W.
B	Lee, John Clarence	Educ; Ministry	W.W.
F	Lee, John Stebbins	Educ; Ministry	W.W.

Lusk, Graham—

F	LUSK, WILLIAM T.	Physiol; Med.	A.C.
MF	Chittenden, Simson B.	Finance; Politics	A.C.

Sewall, Henry—

FF	SEWELL, THOMAS	Medicine	A.C.
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Psychologists

Angell, James Rowland—

B	Angell, Alexis Caswell	Law	W.W.
F	Angell, James Burrill	Educ; Diplomacy	W.W.; A.C.
MF	CASWELL, ALEXIS	Astron; Educ.	A.C.
FBS	ANGELL, FRANK	Psychology	*A.M.S.; W.W.

Angell, Frank—

FB	Angell, James Burrill	Educ; Diplomacy	W.W.; A.C.
FBS	Angell, Alexis Caswell	Law	W.W.
FBS	ANGELL, JAMES R.	Psychology	*A.M.S.; W.W.

Bently, Madison—

F	Bently, Charles E.	Ministry	W.W.; A.C.
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Bryan, William Lowe—

B	Bryan, Enoch Albert	Education	W.W.
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Cattell, James McKeen—

B	CATTELL, HENRY WARE	Pathology	A.M.S.; W.W.
F	Cattell, William	Educ; Ministry	A.C.
FB	Cattell, Alexander	Finance; Politics	A.C.
FBS	Cattell, Edward James	Econ; Geog; Lit.	W.W.
FBS	Cattell, William A.	Engineering	W.W.

Delabarre, Edmund Burke—

B	Delabarre, Frank Alex.	Med; Dentistry	W.W.
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Dewey, John—

B	Dewey, Davis Rich	Econ; Statistics	W.W.
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Hall, Granville Stanley—

MBS	BEALS, EDWARD ALDEN	Meteorology	W.W.
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Jastrow, Joseph—

B	Jastrow, Morris	Theol; Sociol.	W.W.
F	Jastrow, Marcus	Philology	W.W.

Patrick, George Thomas White—

Si	Patrick, Mary Mills	Educ; Writing	W.W.
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Sanford, Edmund Clark—

MSiS	SHINN, CHARLES H.	Botany	W.W.
MSiD	SHINN, MILICENT W.	Psychology	A.M.S.; W.W.

Stratton, George Malcolm—

B	Stratton, Frederick S.	Law	W.W.
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Strong, Charles Augustus—

F	Strong, Augustus H.	Educ; Theology	W.W.; A.C.
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Thorndike, Edward Lee—

B	Thorndike, Ashley H.	Philology	W.W.
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Wells, Frederic Lyman—

F	Wells, Benjamin Willis	Language; Econ.	W.W.
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Woodworth, Robert Sessions—

½B	Woodworth, Frank G.	Educ; Ministry	W.W.
MB	Sessions, William R.	Politics; Agric.	W.W.

Zoologists

Andrews, Ethan Allen—

B	ANDREWS, HORACE	Civil Eng.	A.M.S.
FF	Andrews, Ethan Allen	Lexicography	A.C.

Bruce, Charles Thomas—

½B	Armstrong, William	Musical Criticism	W.W.
½Si	Benough, Elisa A.	Fiction	W.W.

Clark, Hubert Lyman—

F	CLARK, WILLIAM S.	Chemistry	A.C.
MF	Richards, William	Education	A.C.
MBS	WILLISTON, ARTHUR L.	Mech. Eng.	W.W.
MBS	Williston, Samuel	Law	W.W.

Crampton, Henry Edward—

MB	Miller, Charles Henry	Art (Painting)	W.W.; A.C.
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Dahlgren, Ulric—

FB	Dahlgren, Ulric	Warfare	A.C.
FF	DAHLGREN, JOHN A.	Math; Warfare	A.C.

Dall, William Healey—

F	Dall, Charles Henry A.	Ministry	A.C.
M	Dall, Caroline Wells H.	Lecturing; Lit.	W.W.; A.C.

Davenport, Charles Benedict—			
B	Davenport, William E.	Sociol; Ministry	W.W.
Si	Davenport, Frances G.	History	W.W.
Drew, Gilman Arthur—			
B	Drew, William Lincoln	Law	W.W.
Forbes, Stephen Alfred—			
S	FORBES, ERNEST B.	Entomology	W.W.
BS	FORBES, ROBERT H.	Soil Chemistry	A.M.S.; W.W.
Gage, Simeon Henry—			
Si	GAGE, MARY	Sanitation	W.W.
Gerould, John Hiram—			
B	Gerould, Gordon Hall	Philology	W.W.
B	Gerould, James	Library	W.W.
Glaser, Otto Charles—			
F	GLASER, CHARLES	Chemistry	A.M.S.
Grave, Caswell—			
B	GRAVE, BENJAMIN H.	Zoology	A.M.S.
Gulick, John Thomas—			
S	GULICK, ADDISON	Zoology	A.M.S.
F	Gulick, Peter Johnson	Ministry	A.C.
BS	GULICK, LUTHER H.	Physiol; Educ.	A.M.S.; W.W.
BS	Gulick, Sidney Lewis	Ministry; Writing	W.W.
BD	Jewetts, Frances Gulick	Hygiene	W.W.
FBS	Gulick, Charles Burton	Philology	W.W.
Hargitt, Charles Wesley—			
S	HARGITT, GEORGE T.	Geology	A.M.S.
Herrick, Charles Judson—			
B	HERRICK, CLARENCE L.	Neurology	A.M.S.
Howard, Leland Ossian—			
MSiS	Stimson, Henry Lewis	Politics; Warfare	W.W.
MSiD	Keith, Dora Wheeler	Portrait Painting	W.W.
Jayne, Horace—			
B	Jayne, Henry La Barre	Law	W.W.
F	JAYNE, DAVID	Medicine; Pharmacy	A.C.
Lefevre, George—			
B	Lefevre, Albert	Philosophy	W.W.
B	Lefevre, Arthur	Education	W.W.

Lillie, Frank Rattray—				
B	LILLIE, RALPH STAYNER	Zoology	*A.M.S.	
Lillie, Ralph Stayner—				
B	LILLIE, FRANK R.	Zoology	*A.M.S; W.W.	
Loeb, Jacques—				
B	LOEB, LEO	Pathology	*A.M.S; W.W.	
Mayer, Alfred Goldborough—				
F	MAYER, ALFRED M.	Physics	A.C.	
FB	Mayer, Francis B.	Art	A.C.	
Merriam, Clinton Hart—				
Si	BAILEY, FLORENCE M.	Ornithology	A.M.S; W.W.	
FB	Merriam, Augustus C.	Archeol; Philol.	A.C.	
Metcalf, Maynard Mayo—				
B	Metcalf, Irving Wight	Finance;	W.W.	
		Ministry		
B	METCALF, WILMOT V.	Chemistry	A.M.S.	
FBS	Metcalf, Wilder S.	Warfare;	W.W.	
		Finance		
Montgomery, Thomas Harrison—				
B	Montgomery, James A.	Theol; History	W.W.	
MB	Morton, James St. Clair	Warfare	A.C.	
MB	MORTON, THOMAS G.	Surgery	A.C.	
MF	MORTON, SAMUEL G.	Ethnol; Path;	A.C.	
		Anat.		
Moore, John Percy—				
B	MOORE, HENRY FRANK	Zoology	A.M.S; W.W.	
Newman, Horatio Hackett—				
F	Newman, Albert Henry	History; Theol.	W.W.	
Nutting, Charles Cleveland—				
MB	Hunt, Henry	Warfare	A.C.	
MB	Hunt, Lewis Cass	Warfare	A.C.	
Osborn, Henry Fairfield—				
B	Osborn, William Church	Law; Politics	W.W.	
MF	Sturges, Jonathan	Trade	A.C.	
Peckham, George Williams—				
FB	Peckham, R. Wheeler	Law	A.C.	
FBS	Peckham, R. Wheeler, Jr.	Law	W.W; A.C.	
FBS	Peckham, Wheeler H.	Law	W.W; A.C.	
Rice, Edward Loranus—				
F	RICE, WILLIAM NORTH	Geology	*A.M.S; W.W;	
			A.C.	

Shufeldt, Robert Wilson—			
F	Shufeldt, Robert W.	Warfare	A.C.
Stone, Witmer—			
F	Stone, Frederick D.	History; Library	A.C.
True, Frederick William—			
B	TRUE, ALFRED CHARLES	Educ; Agriculture	A.M.S; W.W.
F	True, Charles Kitredge	Ministry	A.C.
Verrill, Addison Emery—			
S	VERRILL, ALPHEUS H.	Zoology	A.M.S; W.W.
Ward, Henry Baldwin—			
F	WARD, RICHARD H.	Bot; Microscopy	A.M.S; W.W; A.C.
FSi	Ward, Anna Lydia	Ethnol; Lexicog.	W.W; A.C.
Weed, Clarence Moores—			
B	WEED, HOWARD EVARTS	Entomology	A.M.S.
Zeleny, Charles—			
B	ZELENY, ANTHONY	Physics	*A.M.S; W.W.
B	ZELENY, JOHN	Physics	*A.M.S; W.W.

RELATIVES OF THE WIVES OF MEN OF SCIENCE

The same general plan used in the listing of the men of science and their distinguished relatives is followed below.

Anatomists

Donaldson, Mrs. Henry Herbert—			
F	Vaux, Calvert	Architecture	A.C.
MB	McEntee, Jervis	Architecture	A.C.

Anthropologists

McGee, Mrs. W. J.—			
F	NEWCOMB, SIMON	Astronomy	*A.M.S; W.W; A.C.
MB	Hassler, Ferdinand A.	Med; Literature	W.W.

Astronomers

Doolittle, Mrs. Charles Leander—			
B	Wolle, Fred	Music	W.W.
S	DOOLITTLE, ERIC	Astronomy	*A.M.S; W.W.
F	WOLLE, FRANCIS	Botany	A.C.

Frost, Mrs. Edwin Brant—			
F	Hazard, Marshal	Editing	W.W.
Holden, Mrs. Edward Singleton—			
B	CHAUVENET, REGIS	Mining Eng.	W.W.; A.C.
B	CHAUVENET, WILLIAM M.	Chemistry	A.M.S.; W.W.
F	CHAUVENET, WILLIAM	Mathematics	A.C.
Loud, Mrs. Frank Herbert—			
B	WILEY, WALTER H.	Mining Eng.	W.W.
Mitchell, Mrs. Samuel Alfred—			
F	DUMBLE, EDWIN T.	Geology	A.M.S.; W.W.
Pickering, Mrs. Edward Charles—			
F	Sparks, Jared	History; Educ.	A.C.
MF	Silsbee, Nathaniel	Politics	A.C.
Pritchett, Mrs. Henry Smith—			
FB	McAllister, Julian	Warfare	A.C.
FF	McAllister, Nath. Hall	Law	A.C.
FBS	McAllister, Ward	Jurisprudence	W.W.; A.C.
Wright, Mrs. William Hammond—			
F	Leib, Samuel	Law; Horticulture	W.W.

Botanists

Atkinson, Mrs. George Francis—			
F	KERR, W. C.	Geology	A.C.
Bessey, Mrs. Charles E.—			
S	BESSEY, ERNST A.	Botany	*A.M.S.; W.W.
Clements, Mrs. Frederic Edward—			
Si	Schwartz, Julia	Literature	W.W.
Coulter, Mrs. John Merle—			
S	COULTER, JOHN G.	Botany	A.M.S.
Coulter, Mrs. Stanley—			
B	Post, Roswell Olcott	Ministry	W.W.
FB	Post, Truman	Ministry	A.C.
Farlow, Mrs. William Gilson—			
Si	Horsford, Cornelia	Archeology	W.W.
F	HORSFORD, EBEN N.	Chemistry	A.C.
M	Horsford, Mary L. H.	Poetry	A.C.
FF	Horsford, Jedediah	Warfare; Politics	A.C.
Ganong, Mrs. William Francis—			
B	Carman, Bliss	Poetry; Editing	W.W.

Greenman, Mrs. Jesse More—			
MSiS	Hartranft, John F.	Politics	A.C.
Pinchot, Mrs. Gifford—			
F	Bryce, Lloyd S.	Editing; Politics	W.W.
MF	Cooper, Edward	Finance; Politics	W.W.
Ramaley, Mrs. Francis—			
F	JACKSON, EDWARD	Ophthalmology	W.W.
Rose, Mrs. Joseph Nelson—			
FB	Sims, Charles R.	Ministry; Educ.	A.C.
Stone, Mrs. George Edward—			
F	CLARK, HENRY JAMES	Botany	A.C.
Wilson, Mrs. William Posell—			
FF	Williams, Charles K.	Politics	A.C.

Chemists

Bigelow, Mrs. Samuel Lawrence—			
MF	Harrison, Joseph	Railroad Building	A.C.
Burgess, Mrs. Charles Frederick—			
B	Jackson, Charles F.	Literature	W.W.
Cushman, Mrs. Allerton Seward—			
B	Hoppin, Joseph Clark	Archeology; Art	W.W.
FB	Hoppin, Augustus	Art; Literature	A.C.
FB	Hoppin, Thomas	Art; Sculptoring	A.C.
FB	Hoppin, William Jones	Stage; Editing	A.C.
Franklin, Mrs. Edward Curtis—			
B	Scott, Charles Fred.	Politics	W.W.
Gies, Mrs. William John—			
MB	Tressler, David	Education	A.C.
MBS	Tressler, Victor	Education	W.W.
Kahlenberg, Mrs. Louis—			
B	HEALD, FRED. DEFOREST	Botany	*A.M.S.; W.W.
Long, Mrs. John Harper—			
FB	Stoneman, George	Warfare	A.C.
Marshall, Mrs. John—			
F	WORMLEY, T. G.	Chemistry	A.C.

Munroe, Mrs. Charles Edward—

F	BARKER, GEORGE FRED.	Physics	*A.M.S; W.W; A.C.
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Osborne, Mrs. Thomas Burr—

F	JOHNSON, SAMUEL WM.	Chemistry	*A.M.S; W.W; A.C.
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Palmer, Mrs. Chase—

FBS	Edwards, Howard	Educ;	W.W.
FBD	Edwards, Louise	Linguistics Literature	W.W.

Pellew, Mrs. Charles Ernest—

F	CHANDLER, CHARLES F.	Chemistry	*A.M.S; W.W; A.C.
FB	CHANDLER, WILLIAM H.	Chemistry	A.M.S; W.W; A.C.

Richards, Mrs. Theodore Wm.—

F	Thayer, Joseph Henry	Theology	W.W; A.C.
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Sanger, Mrs. Charles Robert—

F	Davis, Andrew	Numismatics	W.W; A.C.
FBS	Davis, Hasbrook	Warfare	A.C.
FB	Davis, Horace	Manufacturing	A.C.
FB	Davis, John C. B.	Diplomacy	A.C.
FF	Davis, John	Politics	A.C.
FBS	Davis, John	Law; Diplomacy	A.C.

Saunders, Mrs. Arthur Percy—

F	Brownell, Silas B.	Law	W.W.
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Shimer, Mrs. Porter William—

B	Sandt, George W.	Ministry; Editing	W.W.
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Talbot, Mrs. Henry Paul—

FSiS	Baker, Newton D.	Law; Diplomacy	W.W.
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Tassin, Mrs. Wirt—

F	Moran, Thomas	Art; Exploration	W.W; A.C.
M	Moran, Mary Nimo	Art	A.C.
FB	Moran, Edward	Art	A.C.
FB	Moran, Peter	Art	W.W; A.C.
FBS	Moran, John Leon	Art	W.W; A.C.
FBS	Moran, Edward Percy	Art	W.W; A.C.
FBD	Moran, Annette	Art	W.W.

Van Slyke, Mrs. Lucius L.—

S	VAN SLYKE, DONALD D.	Chemistry	A.M.S.
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Venable, Mrs. Francis Preston—

B	Manning, James S.	Jurisprudence	W.W.
FB	Manning, Thomas C.	Jurisprudence	A.C.

Wiechman, Mrs. Ferdinand G.—

B	Damrosch, Frank	Music	W.W; A.C.
B	Damrosch, Walter	Music	W.W; A.C.
F	Damrosch, Leopold	Music	A.C.

Wiley, Mrs. Harvey Washington—

F	Kelton, John C.	Warfare; Sociol.	A.C.
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Geologists

Brooks, Mrs. Alfred Hulse—

F	BAKER, FRANK	Anatomy	*A.M.S; W.W.
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Chamberlin, Mrs. T. C.

S	CHAMBERLIN, R. T.	Geology	A.M.S; W.W.
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Cross, Mrs. Whitman—

FBS	Stevens, Isaac I.	Exploration; Eng.	A.C.
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Eastman, Mrs. Charles—

F	CLARK, ALVAN G.	Astronomy	A.C.
FF	CLARK, ALVAN	Astronomy	A.C.

Gannet, Mrs. Henry—

FSiS	Gordon, Seth C.	Surgery	W.W.
MSiS	Howe, Lucien	Ophthalmology	W.W.

Grant, Mrs. Ulysses Sherman—

B	WINCHELL, ALEX. N.	Geology	*A.M.S; W.W.
B	WINCHELL, HORACE V.	Geology	A.M.S; W.W.
F	WINCHELL, NEWTON H.	Geology	*A.M.S; W.W; A.C.
FB	WINCHELL, ALEXANDER	Geology	A.C.
FB	Winchell, Samuel R.	Educ; Lit.	W.W.

Harris, Mrs. Gilbert Dennison—

FB	Stoneman, George	Warfare	A.C.
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Hitchcock, Mrs. Charles Henry—

F	Barrows, E. P.	Linguistics	A.C.
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Hobbs, Mrs. William Herbert—

BS	Kimball, Alonzo	Art	W.W.
FSiS	BANISTER, HENRY	Geol; Med.	A.M.S.

Mathews, Mrs. Edward Bennett—

B	WHITMAN, FRANK P.	Physics	*A.M.S; W.W.
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Pirsson, Mrs. Louis Valentine—

F	BRUSH, GEORGE JARVIS	Mineralogy	*A.M.S; W.W; A.C.
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Pumpelly, Mrs. Raphael—

D	Smyth, Margarita P.	Art	W.W.
SiS	Hill, Edward B.	Music	W.W.
MBS	Pope, Alexander	Painting	W.W.

Rice, Mrs. William North—

S	RICE, EDWARD L.	Zoology	*A.M.S; W.W.
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Smith, Mrs. Eugene Allen—

F	Garland, Landon C.	Education	A.C.
FB	Garland, Hugh A.	Law; Warfare	A.C.
FBS	Garland, Hugh A.	Law; Warfare	A.C.
FBS	Garland, Samuel	Law; Warfare	A.C.

Stevenson, Mrs. John James—

BS	Ewing, Nathaniel	Jurisprudence	W.W.
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Vaughn, Mrs. Thomas Wayland—

FF	Upham, Charles W.	Lit; Theol; Polit.	A.C.
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Weed, Mrs. Walter Harvey—

F	Hill, Ebenezer J.	Politics	W.W.
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Willis, Mrs. Bailey—

F	BAKER, FRANK	Anatomy	*A.M.S; W.W.
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Winchell, Mrs. N. H.—

S	WINCHELL, ALEXANDER	Geology	*A.M.S; W.W.
S	WINCHELL, HORACE V.	Geology	A.M.S; W.W.

Mathematicians

Beman, Mrs. Wooster Woodruff—

B	Burton, Ernest DeWitt	Theology	W.W.
B	Burton, Henry	Linguistics; Educ.	W.W.

Echols, Mrs. William Holding—

MB	Tucker, H. St. George	Law	A.C.
MB	Tucker, Nathaniel B.	Law; Literature	A.C.
MF	Tucker, St. George	Linguistics	A.C.
FF	Harrison, Gess	Linguistics	A.C.
MBS	Tucker, John R.	Politics	A.C.
MBS	Tucker, Nathaniel B.	Journal; Lit.	A.C.

Lehmer, Mrs. Derrick Norman—

B	Mitchell, Wesley C.	Economics	W.W.
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McMahon, Mrs. James—			
B	Crane, Thomas F.	Linguistics	W.W.
Moore, Mrs. Eliakim Hastings—			
$\frac{1}{2}$ B	YOUNG, JOHN WESLEY	Mathematics	*A.M.S; W.W.
Peirce, Mrs. Charles Santiago S.—			
Si	Fay, Amy	Music	W.W.
MB	Hopkins, Casper	Journalism	A.C.
MB	Hopkins, Charles J.	Music	A.C.
MB	Hopkins, Edward A.	Finance	A.C.
MB	HOPKINS, FRED. V.	Medicine	A.C.
MB	Hopkins, John H.	Ministry; Poetry	A.C.
MF	Hopkins, John H.	Ministry	A.C.
Roe, Mrs. Edward Drake, Jr.—			
B	Robinson, Maurice H.	Polit. Economy	W.W; A.C.
Veblen, Mrs. Oswald—			
B	RICHARDSON, OWEN W.	Physics	*A.M.S; W.W.

Pathologists

Barker, Mrs. Lewellys—			
B	HALSEY, JOHN TAYLOR	Medicine	A.M.S; W.W.
Cabot, Mrs. Richard Clarke—			
MB	Lowell, John	Jurisprudence	W.W.
MBS	Lowell, Abbot Lawrence	Educ; Hist;	W.W.
MBS	Lowell, Francis C.	Jurisprudence	W.W.
MBS	LOWELL, PERCIVAL	Astronomy	*A.M.S; W.W; A.C.
MBD	Lowell, Amy	Poetry	W.W.
Dana, Mrs. Charles Loomis—			
MB	Opdyke, William S.	Law	W.W.
MF	Opdyke, George	Finance; Politics	A.C.
Edsall, Mrs. David Linn—			
MB	Foote, Arthur	Music	W.W; A.C.
Ernst, Mrs. Harold Clarence—			
B	Frothingham, Louis A.	Law	W.W.
B	Frothingham, Paul R.	Ministry	W.W.
FSi	Ernst, Ellen F.	Linguistics; Lit.	W.W; A.C.
FF	Frothingham, Nathaniel	Ministry	A.C.
MF	Lunt, William P.	Ministry	A.C.
FB	Frothingham, O. B.	Ministry	A.C.
Fitz, Mrs. Reginald Heber—			
F	CLARKE, EDWARD H.	Medicine	A.C.

Flexner, Mrs. Simon—

B	THOMAS, HENRY M.	Neurology	A.M.S; W.W.
Si	Thomas, Carey	Educ;	W.W.
		Literature	

Jordan, Mrs. Edward Oakes—

MBS or MSiS	LOMBARD, W. P.	Physiology	*A.M.S; W.W.
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Meyer, Mrs. Adolf—

Si	Faige, Hildegard B.	Literature	W.W.
B	BROOKS, ALFRED HULSE	Geology	*A.M.S; W.W.
F	BROOKS, T. B.	Geology	A.C.

Mitchell, Mrs. S. Wier—

S	MITCHELL, JOHN K.	Neurology	A.M.S; W.W.
S	Mitchell, Langdon E.	Playwright	W.W.

Pearce, Mrs. Richard Mills—

F	MUSSER, JOHN HERR	Pathology	*A.M.S; W.W.
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Putnam, Mrs. James Jackson—

MB	Channing, William H.	Ministry	A.C.
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Ravenel, Mrs. Mazyeh Porcher—

MF	Allston, R. F. W.	Politics	A.C.
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Warren, Mrs. John Collins—

FB	Shaw, Francis G.	Finance; Sociol.	A.C.
FF	Shaw, Robert G.	Finance;	A.C.
		Warfare	
FBS	Shaw, Robert G.	Warfare	A.C.
FSiS	Oliver, Robert S.	Politics	W.W.

Physicists

Abbe, Mrs. Cleveland, Sr.—

S	ABBE, CLEVELAND, JR.	Meteorology	A.M.S; W.W.
S	ABBE, TRUMAN	Surg; Physiol.	W.W.

Bedell, Mrs. Fred—

B	CREHORE, A. CUSHING	Elec. Eng.	*A.M.S.
B	CREHORE, WILLIAM W.	Civil Eng.	W.W.
MSiS	CUSHING, HARVEY	Pathology	*A.M.S; W.W.
MSiS	CUSHING, HENRY PLATT	Geology	A.M.S; W.W.
MSiS	Cushing, William E.	Law	W.W.

Briggs, Mrs. Lyman James—

F	COOK, ALBERT JOHN	Zoology	A.M.S; W.W;
			A.C.
MB	BALDWIN, JAMES	Surgery	W.W.

Crawford, Mrs. Morris Barker—			
B	RICE, WILLIAM NORTH	Geology	*A.M.S.; W.W; A.C.
BS	RICE, EDWARD LORANUS	Zoology	*A.M.S.; W.W.
Day, Mrs. William Scofield—			
MF	Hoe, Richard	Inventing	A.C.
Dorsey, Mrs. Noah Ernst—			
B	BOWIE, EDWARD H.	Meteorology	W.W.
B	BOWIE, WILLIAM	Geology	A.M.S.; W.W.
Ferry, Mrs. Ervin Sidney—			
F	White, Andrew D.	Educ; Diplom.	W.W; A.C.
Gale, Mrs. Henry Gordon—			
F	Cook, John W.	Education	W.W.
MSiS	Hovey, Richard	Poetry	A.C.
Goodwin, Mrs. Harry Manley—			
MB	FARLOW, WM. GILSON	Botany	*A.M.S.; W.W; A.C.
Ives, Mrs. Frederick Eugene—			
S	IVES, HERBERT EUGENE	Physics	A.M.S.
Jackson, Mrs. Dugald Caleb—			
MB	JORDAN, WHITMAN H.	Agriculture	A.M.S; W.W.
Kimball, Mrs. Arthur Lalanne—			
FB	Scribner, Charles	Publishing	A.C.
MB	Schuyler, George W.	Finance; Polit; Lit.	A.C.
MBS	Schuyler, Eugene	Diplomacy; Lit.	A.C.
King, Mrs. Arthur Scott—			
FSiS	DAINS, FRANK B.	Chemistry	A.M.S.
Magie, Mrs. William Francis—			
FB	Hodge, A. Alexander	Ministry	A.C.
FF	Hodge, Charles	Theology	A.C.
Mendenhall, Mrs. T. D.—			
S	MENDENHALL, C. E.	Physics	*A.M.S; W.W.
More, Mrs. Louis Trenchard—			
Si	Taft, Helen Herron	Society	W.W.
SiD	Taft, Helen Herron	Education	W.W.
Richardson, Mrs. Owen William—			
B	WILSON, HAROLD A.	Physics	W.W.

Snow, Mrs. Benjamin—			
F	Butler, James D.	Literature	W.W; A.C.
Stevens, Mrs. Walter LeConte—			
F	Letcher, John	Politics	A.C.
Thwing, Mrs. Charles Burton—			
B	WHITE, HENRY SEELEY	Mathematics	*A.M.S; W.W.
Trowbridge, Mrs. Augustus—			
F	Fulton, J. D.	Ministry; Lit.	A.C.
Wead, Mrs. Charles Kasson—			
F	Pease, Calvin	Philos; Educ.	A.C.
Webster, Mrs. Arthur Gordon—			
F	Townsend, Robert	Warfare	A.C.
FB	Townsend, F.	Warfare	A.C.
FB	TOWNSEND, ROBERT	Pathology	A.C.
Wright, Mrs. Arthur William—			
F	SILLIMAN, BENJAMIN	Chemistry	A.C.
FF	SILLIMAN, BENJAMIN	Chem; Geology	A.C.
MSiS	DANA, EDWARD S.	Geology	*A.M.S; W.W.
Zeleny, Mrs. John—			
MB	JONES, FREDERICK S.	Physics	*A.M.S; W.W.

Physiologists

Auer, Mrs. John—			
F	MELTZER, SAMUEL J.	Physiology	*A.M.S; W.W.
Dawson, Mrs. Percy Millard—			
B	Learned, Henry Barrett	Lit; History	W.W.
Henderson, Mrs. Lawrence Joseph—			
F	Thayer, Joseph Henry	Bible	W.W; A.C.
Henderson, Mrs. Yandell—			
FB	Colby, Gardner	Philanth;	A.C.
		Railway	
FBS	Colby, Charles L.	Ry. Management	A.C.
FBS	Colby, Everett	Law; Politics	W.W.
FBS	Colby, Henry F.	Ministry	W.W; A.C.
Hough, Mrs. Theodore—			
FBS	WHITEHEAD, RICHARD H.	Pathology	A.M.S; W.W.
Hunt, Mrs. Ried—			
F	Taylor, Hannis	Law; Lit; Diplom.	W.W; A.C.

Lusk, Mrs. Graham—

F	Tiffany, Louis C.	Inventing; Art	W.W; A.C.
FF	Tiffany, Charles L.	Finance; Mfg.	W.W; A.C.

Psychologists

Angel, Mrs. Frank—

F	Bayard, Thomas F.	Diplomacy	A.C.
FF	Bayard, James A.	Diplomacy	A.C.

Buchner, Mrs. Edward Franklin—

MB	Morgan, Daniel Nash	Finance	W.W.
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Jastrow, Mrs. Joseph—

Si	Szold, Henrietta	Language; Editing	W.W.
F	Szold, Benjamin	Ministry; Lit.	W.W.

Strong, Mrs. Charles Augustus—

B	Rockefeller, J. D., Jr.	Finance	W.W.
Si	McCormick, Edith R.	Wealth	W.W.
F	Rockefeller, John D.	Finance	W.W; A.C.
FB	Rockefeller, William	Finance	W.W; A.C.
FBS	Rockefeller, W. G.	Finance	W.W.

Zoologists

Andrews, Mrs. Ethan Allen—

MF	Powell, John Hare	Diplomacy	A.C.
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Calkins, Mrs. Gary Nathan—

B	WILLISTON, ARTHUR	Eng; Educ.	A.M.S; W.W.
B	Williston, Samuel	Law	W.W.

Child, Mrs. Charles Manning—

F	Van Meter, John B.	Philol; Educ.	W.W.
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Forbes, Mrs. Stephen A.

S	FORBES, ERNEST B.	Entomology	W.W.
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Gulick, Mrs. John Thomas—

S	GULICK, JOHN ADDISON	Zoology	A.M.S.
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Hargitt, Mrs. Charles Wesley—

S	HARGITT, GEORGE T.	Zoology	A.M.S.
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Jayne, Mrs. Horace—

B	Furness, Horace H.	Literature	W.W.
B	FURNESS, WILLIAM H.	Anthropology	A.M.S; W.W.
F	Furness, Horace H.	Literature	W.W; A.C.
M	Furness, H. K.	Literature	A.C.
FB	FURNESS, W. H.	Art	A.C.
FSi	Wister, Mrs. A. L.	Linguistics	A.C.
FF	Furness, W. H.	Anthropology	A.C.

Lillie, Mrs. Frank Rattray—

B	Crane, Charles R.	Mfg; Diplomacy	W.W.
F	Crane, Richard Teller	Mfg; Education	W.W; A.C.

Linton, Mrs. Edward—

B	Brownson, M. Acheson	Ministry	W.W.
Si	Brownson, M. Wilson	Math; History	W.W.
MB	Acheson, Marcus W.	Jurisprudence	W.W.
MBS	Acheson, Alex. W.	Med; Politics	W.W.
MBS	ACHESON, EDWARD G.	Chemistry	*A.M.S; W.W.
MBS	Acheson, Ernest F.	Editing; Politics	W.W.
MBS	Acheson, Marcus W.	Jurisprudence	W.W.

Mast, Mrs. Samuel Ottmar—

B	TENNENT, DAVID HILT	Biology	*A.M.S; W.W.
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Mayer, Mrs. Alfred—

Si	Hyatt, Anna V.	Sculptoring	W.W.
F	HYATT, ALPHEUS	Geology	A.C.

Newman, Mrs. Horatio Hackett—

MSiS	LILLIE, FRANK RATTRAY	Zoology	*A.M.S; W.W.
MSiS	LILLIE, RALPH	Physiology	*A.M.S.

Osborn, Mrs. Henry Fairfield—

F	Perry, Alexander J.	Warfare	W.W; A.C.
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Peckham, Mrs. George William—

B	GIFFORD, HAROLD	Ophthalmology	W.W.
FB	Gifford, Sanford R.	Art	A.C.

Pratt, Mrs. Henry Sherring—

MBS	Woodbury, Charles H.	Art	W.W.
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Reighard, Mrs. Jacob—

FBS	FARRAND, LIVINGSTON	Anthropology	*A.M.S; W.W.
FBS	Farrand, Max	History	W.W.
FBS	Farrand, Wilson	Editing; Educ.	W.W.

Sedgwick, Mrs. William Thompson—

B	Rice, Richard Austin	Languages; Hist.	W.W.
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Shufeldt, Mrs. Robert Wilson—

FF	AUDUBON, JONATHAN J.	Ornithology	A.C.
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Smallwood, Mrs. William Martin—

MB	COIT, JUDSON BOARDMAN	Astronomy	A.M.S; W.W.
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Stiles, Mrs. Charles Wardell—

MB	FORDYCE, JOHN A.	Dermatology	W.W.
MB	Fordyce, Samuel W.	Finance	W.W.

Strong, Mrs. Reuben Myron—			
F	Freeman, Henry V.	Jurisprudence	W.W.
MB	Curtis, Edward Lewis	Literature	W.W.
MF	Curtis, William S.	Education	A.C.
True, Mrs. Frederick William—			
F	PRENTISS, DANIEL W.	Medicine	W.W.
Verrill, Mrs. Addison Emory—			
B	SMITH, SIDNEY	Zoology	*A.M.S.; W.W.
S	VERRILL, ALPHEUS H.	Zoology	A.M.S.; W.W.
Wilson, Mrs. Henry Van Peters—			
MB	STEDMAN, HENRY RUST	Pathology	A.M.S.; W.W.
Zeleny, Mrs. Charles—			
MB	ERIKSON, HENRY ANTON	Physics	A.M.S.

DISTINGUISHED WIVES OF AMERICAN MEN OF SCIENCE

Anatomists

Lewis, Warren Harmon—			
	LEWIS, MARGARET REED	Biology	A.M.S.

Anthropologists

McGee, W. J.—			
	MCGEE, ANITA NEWCOMB	Medicine	A.M.S.; W.W.

Botanists

Wilson, William Powell—			
	WILSON, LUCY M. WILLIAMS	Biology	A.M.S.; W.W.

Chemists

Norton, Thomas Herbert—			
	Norton, Edith Eliza Ames	Literature	W.W.
Phelps, Isaac King—			
	PHELPS, MARTHA AUSTIN	Chemistry	A.M.S.

Geologists

Grabau, Amadeus William—			
	Grabau, Mary Antin	Literature	W.W.

Mathematicians

Franklin, Fabian—			
	FRANKLIN, CHRISTINE LADD	Psychology	*A.M.S.; W.W.
Peirce, Charles Santiago Sanders—			
	Peirce, Harriet M. Fay	Literature	W.W.

Pathologists

Cabot, Richard C.—

Cabot, Ella Lowell Lyman	Philos; Education	W.W.
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Physicists

Barus, Carl—

Barus, Annie G. Howes	Literature	W.W.
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Zoologists

Andrews, Ethan Allen—

ANDREWS, SARA G. FOULKE	Zoology	A.M.S.
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Calvert, Philip Powell—

CALVERT, AMELIA K. SMITH	Zoology	A.M.S.
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Comstock, John Henry—

COMSTOCK, ANNA BOTSFORD	Entomology; Art	A.M.S; W.W.
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Davenport, Charles Benedict—

DAVENPORT, GERTRUDE CROTTY	Zoology	A.M.S.
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Gage, Simon Henry—

GAGE, SUSANNA PHELPS	Zoology	*A.M.S; W.W.
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Jayne, Horace—

Jayne, Caroline G. Furness	Literature	W.W.
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Moore, John Percy—

MOORE, KATHLEEN CARTER	Psychology	A.M.S.
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Nickerson, Winfield Scott—

NICKERSON, MARGARET LEWIS	Histology; Embryol.	*A.M.S.
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Peckham, George William—

-PECKHAM, ELIZ. M. GIFFORD	Zoology	A.M.S; W.W.
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Wilder, Harris Hawthorne—

WILDER, INEZ WHIPPLE	Zoology	A.M.S; W.W.
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(To be continued)

FAMILY RESEMBLANCES AMONG AMERICAN MEN OF SCIENCE

II. DEGREE OF RESEMBLANCE IN COMPARISON WITH THE GENERALITY: PROPORTION OF WORKERS IN EACH SCIENCE AND DISTRIBUTION OF REPLIES

DR. DEAN R. BRIMHALL

SECRETARY OF THE PSYCHOLOGICAL CORPORATION

THE methods used in determining the number of workers in the various fields of science resulted in distributing the thousand as recorded in the first column of the table below. The second column shows the number of replies from those in the several divisions, of whom, owing to two selections of the group, there were 1,154.

TABLE I

Science	1	2
Astronomy	50	44
Chemistry	175	167
Geology	100	90
Mathematics	80	76
Physics	150	161
Anatomy	25	23
Anthropology	20	18
Botany	100	97
Pathology	60	56
Physiology	40	37
Psychology	50	43
Zoology	150	144
Total	1,000	956

It is obvious without expressing the replies in ratios per one thousand that they are evenly distributed, the only variation in any way unusual being those in the physics group, and the relatively large number makes that difference of little consequence.

RESEMBLANCE IN DISTINCTION COMPARED WITH THE GENERALITY

Two hundred and fifty-six, or more than one in four of those reporting, are known to have distinguished relatives

no more remote in relationship than cousin. Table I has given the facts concerning the distribution of replies, showing the evenness of the selection. Table II gives the facts concerning the distribution of those replying and the numbers with distinguished relatives.

TABLE II

Science	(1) Number Report- ing	(2) Number Known to have Dis- tinguished Relatives	(3) Column (2) Reduced to Number per 1,000	(4) Number of Dis- tinguished Relatives	(5) Number of Dis- tinguished Relatives per 1,000
Astronomy.....	44	10	227	17	386
Chemistry.....	167	43	257	96	575
Geology.....	90	35	389	65	722
Mathematics.....	76	14	184	28	368
Physics.....	161	38	236	82	509
Anatomy.....	23	7	304	11	478
Anthropology.....	18	3	167	5	278
Botany.....	97	22	227	36	371
Pathology.....	56	21	375	39	696
Physiology.....	37	8	216	20	541
Psychology.....	43	16	372	28	651
Zoology.....	144	39	271	71	493
Total.....	956	256	267.8 $\pm$ 14	498	521

It will be seen that 44 astronomers replied, and that 10 were found to have one or more distinguished relatives of a degree no more remote than cousin. This means that for 1,000 astronomers there would be 227 with distinguished relatives. Of 1,000 chemists 257 would have distinguished relatives, as defined. The average for the twelve groups is shown to be 267.8 with a p.e. of 14. The number of relatives per thousand men reporting is given in the last column. Forty-four astronomers are represented by 386 persons of distinction; 167 chemists by 575 persons of distinction; geology by 722; mathematics by 368, and so on. The average for this set of values is 521. Two hundred and fifty-six men of science have 498 relatives as defined; this is practically two per man. The exact value per man being $1.95 \pm .06$, using the following values for the twelve sciences as the distribution for which the p.e. is obtained: The number per

man for astronomy is 1.7; for chemistry 2.2; for geology 2.1; mathematics 2.0; physics 2.2; anatomy 1.6; anthropology 1.7; botany 1.6; pathology 1.9; physiology 2.5; psychology 2.5, and zoology 1.8.

TABLE III

DISTRIBUTION OF THE BIOGRAPHIES IN "AMERICAN MEN OF SCIENCE," "WHO'S WHO IN AMERICA" AND "APPLETON'S CYCLOPEDIA OF AMERICAN BIOGRAPHY," AND THE STARRED GROUP OF "AMERICAN MEN OF SCIENCE," ACCORDING TO NUMBER IN EACH DEGREE OF RELATIONSHIP.

	Total in All Three Books	Distribution in the Three Hand-books and in the Starred Group			
		A	W	E	X
B.....	146	62	121	18	26
Si.....	13	2	13		
S.....	18	15	13		5
D.....	1		1		
F.....	78	17	40	52	5
M.....	3		2	2	
FB.....	33	1	13	26	
FSi.....	4		3	3	
MB.....	31	1	11	25	1
MSi.....					
BS.....	6	5	5		
BD.....	3		3		
SiS.....	3	2	3		1
SiD.....					
FF.....	17			17	
FM.....	1			1	
MF.....	35		2	35	
MM.....	1			1	
FBS.....	45	15	37	7	9
FBD.....					
FSiS.....	15	4	13	2	3
FSiD.....	2		2		
MBS.....	20	7	18	6	4
MBD.....	1		1		
MSiS.....	18	7	16	3	4
MSiD.....	4	1	4		
Total.....	498	139	321	198	58

A denotes "American Men of Science."

W denotes "Who's Who in America."

E denotes "Appleton's Cyclopaedia of American Biography."

X denotes members of the 'starred' group in "American Men of Science."

At first sight it might seem that the mathematical sciences had a definitely greater number of relatives per man than the more descriptive and biological sciences.

The exceptions in the case of astronomy, physiology and psychology discount the evidence in the other cases. It is likely that a careful analysis of the relation between the number of men reporting relatives and the number of relatives per man would reveal facts of significance. As the figures stand, it seems best to accept them as chance variations.

The range of selection in time and people covered by three handbooks used to determine distinction of those found makes direct comparisons of the totals in Table II less clear than is desirable.

Table III gives the distribution of the 498 relatives listed in Table II and shows (1) the number in each degree of relationship, (2) the number in each one of the three handbooks and the number in the starred group. Thus, there are 146 brothers found in one or more of the three handbooks. Of these, 62 are in *American Men of Science*, 121 are in "*Who's Who in America*" and 18 are in "*Appleton's Cyclopedia of American Biography*." Of the 62 in "*American Men of Science*" 26 are in the starred group. The significance of Table III lies mainly in the simple way it expresses some of the complicated results of the study. It is an appropriate introduction to the detailed Table IV which follows the account of the duplications in relationship.

"DUPLICATED" RELATIVES

It is well to call attention to the fact that the word relationships might better be used than relatives. It is quite correct to say that 956 men are known to have 146 distinguished brothers, although six of these brothers are counted twice as brothers and seven are counted again as cousins of 146 distinguished brothers. It may seem illogical to count such cases twice, yet no better treatment is evident. The fact remains that if we consider each person in our group as an individual, there are 146 brothers of these several individuals. If the six repetitions in the brother relationship are to be eliminated, which brother is to be deprived of a relative? The total

known repetitions are 31; less than 6.5 per cent. of the 498 relationships.

TABLE IV

	Distribution of Those Distinguished in Science										Distribution of Those Not Distinguished in Science				Total for Both Groups
	A	W(S)	E(S)	AW	WE	XA	XAW	AWE	XAW	Total in Science	W	E	WE	Total not in Science	
B.....	18	10	3	15		1	21	3	4	75	63	3	5	71	146
Si.....		2		2						4	9			9	13
S.....	5	2		5			5			17	1			1	18
D.....										1				1	1
F.....	3	1	14	3	1		2	6	3	33	17	21	7	45	78
M.....											1	1	1	3	3
FB.....			6	1						7	6	14	6	26	33
FSi.....										1	1	1	2	4	4
MB.....			7		1				1	9	6	13	3	22	31
MSi.....															
BS.....	1			4						5	1			1	6
BD.....											3			3	3
SiS.....				1			1			2	1			1	3
SiD.....															
FF.....			3							3		14		14	17
FM.....												1		1	1
MF.....			10							10	23	2		25	35
MM.....												1		1	1
FBS.....	3	4	2	3			9			21	19	3	2	24	45
FBD.....															
FSiS.....	1	1					2		1	5	9	1		10	15
FSiD.....											2			2	2
MBS.....		2	1	3			2		2	10	7	1	2	10	20
MBD.....		1								1					1
MSiS.....	1	2		2			3		1	9	7	1	1	9	18
MSiD.....										1	3			3	4
Total.....	32	25	46	40	2	1	45	9	12	212	157	98	31	286	498

Here is shown the distribution of the relatives (1) according to the number in each degree of kinship, (2) according to the number of handbooks in which the biographies are found, (3) the number in the starred group, (4) the number distinguished in science, (5) the number not distinguished in science, although eminent in some other activity than science. In column two under A,

we have the number 18. This means that 18 brothers are listed in "American Men of Science" and in no other handbook. W(S) indicates that 10 brothers who were distinguished in science were listed in "Who's Who in America" but in no other handbook. The E(S) means the same for Appleton's "Cyclopedia of American Biography." The other combinations mean that the individual is in the starred group (marked X) and the books represented by the letters. Thus, in vertical column under XAWE, we have listed the relatives who belong to the starred group and who are mentioned in all three handbooks. The column of totals beginning with 75 gives the number in each degree of kinship who are distinguished in science. The next section to the right gives the same sort of distribution for the biographies of those shown not to be distinguished in science.

All persons counted as belonging to the "science" group have been indicated in the lists by having their names printed in small capitals. Inclusion in "American Men of Science," membership in scientific societies with "performance" qualifications, teaching position in science, university degrees from departments of science, were the criteria on which most of the persons were counted as belonging to the group distinguished for performance in science. Some few, especially those whose records were found only in Appleton's Cyclopedia, were counted as scientific if the descriptive accounts were judged to warrant such inclusion. Where individuals were distinguished in science and other fields as well, they were counted in the first group. A more detailed analysis of the problem of specialization of resemblance is given in a following chapter.

COMPARISON OF THE BROTHERS WITH THE BROTHERS OF THE GENERALITY

It has been found desirable in the interest of simplicity and accuracy to compare part of the group of brothers listed in "Who's Who in America" with men of the generality. These brothers are those found listed in Vol. 7

(1912-13). The advantages of such a limitation are (1) that the selection is general, that is, it is not limited to one field of activity but is supposed to cover all fields with a measure which includes people of approximately the same minimum grade, (2) the number of living notables in the book may be compared with the generality, and more particularly the number of the same age limits, (3) this volume covers very nearly the exact period at which requests were being answered by the members of the group studied.

Table V gives the distribution of brothers selected in this manner and arranged according to the scientific activity of the men whose brothers they are, also according to the number who have worked in science and the number who have not.

TABLE V
DISTRIBUTION OF BIOGRAPHIES OF BROTHERS IN VOL. 7, 1912-13, WHO'S
WHO IN AMERICA

Science	Number Reporting	Number of Brothers Found Listed in Vol. 7 of W. W. in A.	Number in Science	Number Not in Science
Astronomy.....	44	5	3	2
Chemistry.....	167	16	8	8
Geology.....	90	14	6	8
Mathematics.....	76	5		5
Physics.....	161	20	13	7
Anatomy.....	23	1		1
Anthropology.....	18	3	1	2
Botany.....	97	8	5	3
Pathology.....	56	8	4	4
Physiology.....	37	2		2
Psychology.....	43	9	1	8
Zoology.....	144	15	6	9
Total.....	956	106	47	59

Table V shows that 956 men of science have 106 brothers listed in the particular volume chosen. This volume has a total of 18,794 sketches of which approximately nine per cent., or 1,700, are women. Thus, there are 17,000 of the generality of 1911 who are comparable with 106 brothers of men of science.

The average age at which men become mentioned for the first time in "Who's Who in America" was determined for volume six, and found to be 49.9 years. It would not be far different for the years covered by the next volume. The average age of men of the starred group at the time of the second selection was 48.12 years. In 1911, the time at which the replies to the requests were being received, the men themselves and their brothers would have almost reached this average age at which men are included. The brothers of the men of the starred group are, thus, rather nicely comparable with those included in volume 7 of "Who's Who in America," so far as age limits are concerned.

The selection of a number of men of the generality comparable with the 956 men of science is not so simple. The most reasonable method seems to be that of determining the number of males of the total population in 1911 above the median age at which they first attain a place in the handbook, then adding a like number from the total of the male population below this point. Use of this method gives a total of approximately 14,000,000 males for the group who are comparable with men in "Who's Who in America" and the men of science.

There are approximately 17,000 men of the "Who's-Who-in-America" grade and 956 men of science who are comparable so far as the age factor is concerned, with 14,000,000 males of the generality. Among the 14,000,000 males of the generality 17,000 are distinguished by having biographical accounts in "Who's Who in America." The average man of the group comparable with the men of science had, therefore, one chance in 823.5 to be included in that book. One thousand men of the generality had a little more than one and one fifth (1.214) of a man included.

How do the brothers of distinguished men of science fare? According to the data presented by the men themselves on number of living brothers and the number found to be distinguished by the writer, 1,000 brothers of distinguished men of science have 87.75 among them who are

distinguished as defined. The ratio of these two proportions, 1.214 and 87.75, is as 1 to 72.78. According to these figures, if two men, one a brother of a man of science and one a man of the generality, shake dice for distinction, the brother of the man of science would win nearly 75 times to one winning by the man of the generality.

How were these ratios obtained? Nine hundred and fifty-six men of science were found to have 106 brothers with biographical histories in "Who's Who in America" in Vol. 7, 1912-13 (Table V). This gives a ratio of 110.88 per thousand. Eight hundred and eighty-four men reported having 1,726 brothers, of whom 1,107 were living at the time of the report in 1910-11.

One thousand men of science would, therefore, have 1,263.6 brothers living at the time in question, of whom 110.88 or 87.75 per one thousand would be distinguished. The ratio of 17,000 in "Who's Who" to the comparable group of the generality, 14,000,000, being 1.214 per thousand, the brothers of men of science are, under the given conditions, 72.78 times as likely to become distinguished as the men of the generality.

There are factors tending to make this difference too small. Deaths of some of the brothers may have been omitted. Of this Cattell has said in his discussion on vital statistics:

It is difficult to see how more valid statistics can be obtained than those supplied by scientific men, the order of birth, the dates of birth and death having been given; yet it is undoubtedly the case that all deaths are not recorded, especially for the brothers and sisters who died in infancy.¹

A second factor is that of omissions in cases of distinguished brothers. Some few may have escaped notice in the search for those recorded in the particular volume used, but it is thought that there were few so omitted. It is true that the original reports failed to give anything like a complete account of the relatives who were known for their special performance in the various activities of life. A great many were reported who were not found recorded in any handbook and this is a feature that is of

¹ *Scientific Monthly*, October, 1917.

considerable importance, but it is a fact that but 84 brothers were given in the original reports who were found to be distinguished, while 146 were later found in one or more of the three handbooks used. Twenty-five of these were found to have become known during the course of the investigation, that is, included in editions of "Who's Who in America" for the first time after 1910-11. But if these factors were at work they tended to make the differences less than the figures indicate. The great difference as it stands, 1 to 72.78, is of sufficient validity to point to a resemblance between men of science and their brothers, and resemblance of the generality.

If we could know the number of brothers the men of the generality had and the number who became distinguished we could express the difference in resemblance of families of men of science and families of the generality. We do not know these facts, but the reader will see that the figures can not be far different from those given for the generality. The men of the generality would have approximately the same number of brothers per thousand as the men of science, and the 17,000 would be distributed among them in the same proportion as they are among the 14,000,000.

Fourteen millions may be a group unfairly large, that is, unfairly large as a number comparable to the thousand men of science. No better method than that used is known. The reader may make whatever selection of the general population he thinks best; he will find a difference that is highly significant, one that can not be explained as a matter of chance.

If 17,000 distinguished men of the generality came from a group of 14,000,000, the 106 brothers of men of science would, as a matter of chance, have had to come from a group of more than 84,000. What this means is that each man of science would have had to have about 80 brothers if the latter were no more likely than a man of the generality to become distinguished. If by some miracle towns and cities competed for honors determined by production of men of science, a country town of 7,000,

peopled by families of the grade of brothers of American men of science, would have to be handicapped by putting it with cities having a population of half a million if that competition were to be interesting.

RESEMBLANCE IN SCIENCE

What is the resemblance in performance in science? Table V gives the distribution of 106 brothers according to the direction of the work of the men whose brothers they are. It also gives the distribution according to two groupings, those whose work has been in science and those whose work has been in fields other than science. Some of those in the first group, the science group, have shown special performance in fields other than science, but none of those listed in the "non-scientific" group is known to have achieved distinction in science. It must also be noted that 28 brothers who have shown special performance in science are not included in this table. They are not included because they are not found in the particular handbook used in obtaining these ratios. Some of the 28 are in "American Men of Science," some are included in Appleton's Cyclopedia and some are in Who's Who of editions other than that used, namely, Vol. 7. The same holds true for biographies of 13 men whose work was not in science. The details of these facts may be seen at a glance in Table IV.

There were, as Table V shows, 47 distinguished in science and 59 who were not distinguished in science. Since there were approximately 2,500² or about one seventh of the 17,000 males in Vol. 7 who were workers in science, the chances of a man of the generality becoming distinguished, as defined, in that field is approximately one in 5,600.

It has been shown that 1,000 men of science would have about 1,300 brothers comparable, in age, with 14,000,000 of the generality. Since 956 men of science

² The biographies of the first 400 pages in Vol. 6 were gone over carefully and the number, per hundred pages, who had done work in science that would merit inclusion in such a book as "American Men of Science" was determined. The number in the remainder of the book was an estimate.

with x brothers had 47 brothers distinguished in science, 1,000 men of science with 1,263 brothers would have 49,2 so distinguished. If but one man in 5,600 of the generality achieves similar distinction, the brother of the man of science is 217 times as likely to become distinguished in science as a man of the generality.

Much might be said about the relative chances of distinguished financiers or industrial leaders and men of science having their biographies recorded in such a handbook as the one used in this investigation. It may be that men of science, being associated with public institutions such as schools, or large industrial laboratories, become known to the public and hence have their biographies recorded, although their performance no more merits it than, say, the high-priced manager of a department store. If such discrimination in favor of university people, especially men of science, exists, it should be determined. The facts are that so far as distinction goes there is family resemblance in the matter of achieving distinction, and that resemblance is greater in the direction of the specialized activity of science. The next section gives additional evidence of this specialized resemblance.

THE STARRED GROUP

There were 26 of the brothers who were members of the starred group. That is, 26 of the brothers of the men of science belong to the group itself. Three, however, were in the first edition only, leaving but 23 for comparisons with the groups under consideration. Since 23 of the x number of brothers of 956 men of science belonged to the starred group, 24 of the 1,263 brothers of 1,000 men of science would belong to the starred group. About two per hundred, or 20 per one thousand belong to the starred group, whereas 14,000,000 men of the generality have one for about 1,150 of their number. The brothers of men of science, therefore, have according to their numbers about 230 times as many of their

group belonging to the starred group as men of the generality.

There are in the starred group of relatives 58 relationships; 26 brothers, five fathers and five sons, one uncle, one nephew and 21 cousins. Only the brothers and cousins are comparable groups and the figures show that four fifths as many male cousins as brothers obtained positions in the starred group. There are, however, four times as many male cousins as brothers who have as a matter of chance the opportunity to obtain such a position. This evidence may be used as the reader sees fit. He may explain the difference in terms of nepotism or as congenital equipment which in turn may be explained by similarity in germ plasm which varies directly as the nearness of blood relationship. The figures show that a brother of a starred man is five times as likely to belong to the starred group as a male first cousin.

SISTERS

In Table IV will be found the distribution of the biographies of the 13 sisters who are known to be distinguished. All 13 are found in "Who's Who in America," but only 11 are recorded in Volume 7. By the use of the method employed in the selection of the 14,000,000 of the generality for comparison in the case of the brothers, there would be found approximately 13,000,000 females for a similar comparison for the women. Since the number of women in Volume 7 of "Who's Who" is approximately 1,700, the relation between the number of women who achieve distinction and the number who are of the same average age limits is found to be as one is 7,647, or .131 per thousand. Ten thousand adult women of the age limits assumed would, according to these figures, be represented by one and a third of their sex. Ten thousand men of the grade of our group would have, according to the figures above, 115 distinguished sisters. This seems to be a startling difference in spite of the small number of cases of sisters.

There were 884 records of men who reported the facts

concerning sisters living in 1910-11. They reported having 1,043 living at that time. If this number is correct, 1,000 men would have had, approximately, 1,180 sisters, of whom 11.5 would be distinguished. Since 11.5 in this number, or 9.28 per thousand were distinguished, in the same sense that .131 of the generality were distinguished, a sister of a starred man of science is 70.8 times as likely to achieve distinction as a woman of the generality.

It would be uncritical to make much of the close resemblance between the two values obtained in the matter of resemblance of men of science to their brothers and sisters. The fact that the number turns out to be approximately 70 in both cases is interesting and perhaps significant in spite of the small number of sisters found in the handbook used.

It is not known what per cent. of the women of distinction are workers in science but certainly not ten per cent. About five per cent. of the persons included in "American Men of Science" are women. Four, or over a third of the eleven of the sisters are known for their work in science. Here again, in spite of small numbers, the evidence of family resemblance is in the direction of specialized performance.

FATHERS

There were 944 replies giving the necessary vital statistics of the fathers living in 1910-11. There were 246 reported living. There were 29 of these 246, or, 117.9 per thousand included in Volume 7 of "Who's Who in America." Eleven, or over one third, were distinguished in science. On first thought it might be supposed that this is evidence of a greater resemblance between men of science and their fathers than between themselves and brothers. This, of course, would be a difficult matter to explain in organic terms. The greater the number of years a man lives, the greater his opportunity, other things being equal, of obtaining a place in the ordinary biographical handbook. The chances of a person who dies at 20 are practically nil. Relative length of life may be the explanation.

MOTHERS

Three mothers of the 956 are known to be distinguished. This number, though small, is significant. The reader may be interested in turning to Table IV and noting the number of distinguished brothers and fathers of the mothers.

Social inheritance, such as family tradition, family wealth and occupation may direct the activities of an individual. It may be that families with university traditions have a very special advantage over the ordinary family in its chances for distinction. If this is so, more people should have the opportunity for university traditions.

SUMMARY

The investigation has shown: (1) That more than one man in four of the starred group of American Men of Science is related to one or more persons of distinction as defined; (2) that for one particular measure of distinction, the brothers of men of starred group are approximately 70 times as likely to become distinguished as a man of the generality; (3) that the resemblance is in the direction of the performance as well as the quality as shown by the number of brothers distinguished in science, being for the brothers 217 times that of the generality; (4) that the resemblance within the starred group gives additional evidence of specialization in similarity, being for brothers 230 times that of the generality and four times that of cousins; (5) that the data on the sisters closely approximate the figures on the brothers, though the number involved is small—the figures go to show that the sisters were approximately 70 times as likely to become distinguished as women of the generality; (6) that the direction of the performance was again favorable to science, being one third of the total, but that the small number concerned makes significance questionable; (7) that 29 of the 246 fathers or 117.9 per thousand of those living at the time of the investigation were men of distinction; (8) that three mothers were women of distinction.

(To be continued)

FAMILY RESEMBLANCES AMONG AMERICAN MEN OF SCIENCE

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III. THE INFLUENCE OF THE NEARNESS OF KINSHIP

It would seem reasonable to suppose that the nearer men are in "blood relationship," the greater would be the resemblance in performance. Brothers are more nearly related than father and son; do the brothers of distinguished men of science outnumber the sons, or the fathers, or the uncles? It has been shown that brothers resemble each other in performance in science more than cousins. In proportion to their numbers about five times as many brothers of starred men obtain positions in the starred group as cousins. Is there an increasing number of distinguished relatives with increasing closeness of relationship? The results recorded in this chapter show that there is.

DEGREES OF KINSHIP

If for no other reason than that reproduction of human beings is bisexual it is reasonable to suppose that brothers are more nearly related than cousins or than grandsons and grandparents. The zygotes from which brothers grow are each the result of a combination of individual cells (gametes) from two different groups of cells. If we assume that the germ cells from the male vary about a common point which in turn varies from the common point of the species, the chances are that the offspring will vary from the mid-measure of the species in the direction of the variation of the parent. If we assume that the parent's qualities give a clue to the kind of germ cells he carries, that is, if we assume that a man of genius carries germ cells which vary as a group from the germ cells of the species and that the average of these variable

cells of the individual closely resembles the zygote from which the man developed, the chances are certainly remote that the maternal side will furnish a gamete for the union that will maintain the zygotic resemblance.

The problem of apparent blending in resemblance as in the case of pigmentation of offspring of negroes and whites and of Mendelian or alternative inheritance in the case of eye color are beyond the scope of this study. Biologists do not seem to be agreed on the decree to which one may generalize, as the following quotation would seem to show:

It seems best, accordingly, to attempt neither with Galton to generalize all inheritance as blending nor with Johannsen to treat all inheritance as alternative, but frankly to recognize the existence of two categories of cases distinct in their inheritance behavior.¹

Whatever the method, blending or alternative or both without a very exact assortive mating the union of two gametes will produce an individual that is as a matter of chance less likely to resemble either parent than if the individual developed asexually. This factor, then, would tend to decrease the resemblance of near relatives to a degree that would vary as the number of matings is involved. If the gametes of any individual actually vary about an average that is approximated by the zygote from which the individual who carries them grew, it is likely that of two brothers one carries a group of germ cells superior, on the average, to the germ cells of the other. It is conceivable that the "inferior" of the two carries a group of cells superior to the "superior" brother. Speculations of this sort belong to workers more familiar with experimental genetics. They are given as suggestions of the complications of the apparently simple problem of determining the relative influence of the different ancestors.

DISTINGUISHED RELATIVES IN EACH DEGREE OF KINSHIP

Whatever the values of the intervals between the different relationships may be, the following order is

¹ W. E. Castle, "Genetics and Eugenics," 1916, p. 218.

assumed to be valid in the sense that closeness varies according to the following order:

- (1) Brother and sister
- (2) Father, mother, son and daughter
- (3) Uncle, aunt, niece and nephew
- (4) Grandparent
- (5) Cousin

The details concerning the number of relatives of distinction in each specific relationship are given in table four but they are repeated as part of table six to facilitate comparison. It will be noted that the specific kinships recorded in this table are arranged in the assumed order of nearness.

TABLE VI

	Detailed Grouping		Totals of Each in Course Grouping
Brothers and sisters	B.	146	159
	Si.	13	
Sons, daughters, fathers and mothers	S.	18	100
	D.	1	
	F.	78	
	M.	3	
Uncles, aunts, nieces and nephews	FB.	33	80
	FSi.	4	
	MB.	31	
	MSi.		
	BS.	6	
	BD.	3	
	SiS.	3	
	SiD.		
Grandparents	FF.	17	54
	FM.	1	
	MF.	35	
	MM.	1	
First cousins	FBS.	45	105
	FBD.		
	FSiS.	15	
	FSiD.	2	
	MBS.	20	
	MBD.	1	
	MSiS.	18	
	MSiD.	4	
Total	Total . . .	498	498

It is obvious that the raw totals in the course grouping are without significance except as they give a sort of bird's-eye view of the situation. It can be seen at a glance that eight specific first cousin relationships do not furnish as many relatives of distinction as the two relationships of brother and sister. The comparison is no less striking if only the males are considered. In this comparison there are 146 brothers and 98 first cousins. These two groups happen to be rather directly comparable, the factors making for inclusion of those of the one group about equalling the factors making for inclusion of members of the other. But the other relationships and the source of those included make certain considerations of importance necessary. Two of these considerations are (1) the number of persons in each specific relationship, that is, the number of brothers, the number of sisters, the number of mothers, fathers, the number of individuals in each one of the eight first cousin kinships and so on; (2) the equality of certain of the chance factors determining inclusion for the different groups in any one of the handbooks by which distinction is measured.

In direct ancestry the number in each degree of kinship is obvious. A man has in each and every specific ancestral relationship one relative. He has one father, one mother, one FF', one MF', one FFF', and so on *ad infinitum*. Furthermore, each of the individuals in the direct ancestry reaches an adult age, if ability to reproduce is a measure of maturity. Certainly, all do not reach the average age at which men obtain a place in a biographical handbook. Age and number of offspring have a positive correlation, however.

In the collateral ancestry and in descendants the number does not lend itself so easily to deduction. In a stationary population the average number of fertile relatives in each specific kinship would equal the number of ancestors in each specific relationship, which has been shown to be one.² Furthermore, Galton, in the work just

² Noteworthy families, Galton and Schuster, p. 33.

cited, proposes: "that the number of fertile individuals is not grossly different to that of those who live long enough to have an opportunity of distinguishing themselves."

Galton's study dealt with the families of members of the Royal Society living in 1904. The data concerning the near relatives of 100 of these men were collected and the findings on the number in each specific relationship are given in the table below (see Table VII).³

TABLE VII

Kinship (Males)	Number	Kinship (Females)	Number
Brothers	206	Sisters.....	207
Uncles (FB).....	228	Aunts (Fsi).....	207
Uncles (MB).....	219	Aunts (MSi).....	238
Cousins (FBS).....	263	Aunts (FBD).....	302
Cousins (FSiS).....	184	Aunts (FSiD).....	208
Cousins (MBS).....	236	Aunts (MBD).....	266
Cousins (MSiS).....	237	Aunts (MSiD).....	246
Totals.....	1575		1674
Average per man.....	2.25		2.39

For our purposes these data are important in showing that whatever the number of relatives in specific degrees of relationship may be, it is approximately the same for those relationships other than direct ancestry. Direct ancestry can not include infertile people; collateral ancestry and direct descendants furnish the infertile part of the population, that is, those who die before maturity and those who reach maturity but do not reproduce. If the above is a correct analysis, it would seem proper to compare the direct ancestors, coming from a stationary population, with each other, allowing only for the relative number in each degree. Such an arrangement would result in an order beginning with the father-mother relationship of two and would increase by doubling in each successive degree of remoteness, as follows:

Father-mother	2
Grandparent	4
Great-grandparents, etc.	8

³ *Ibid.*, p. 30.

The progression for the collaterals and descendants, beginning with the brothers, would be:

Brother-sister	$2 + 2x^4$
Son-daughter	$2 + 2x$
Uncle-aunt	$4 + 2x$
First cousin	$8 + 8x$

Owing to the completeness of the reports by the men of science it is possible to determine, that for the brothers and sisters X is not smaller than .22. For 1,000 men of science the computations showed 1,264 brothers and 1,180 sisters, *i.e.*, 2,440 siblings, living at the time the replies to the questionnaire were sent in. This means that there were 2.44 siblings per man in these relationships, or approximately 1.26 per brother relationship and 1.18 per sister relationship. It seems reasonable to suppose that these figures are too high. The death rate among the professional classes is said to be lower than among the generality, but such a low death rate as these figures would indicate is probably incorrect. If a comparison were to be made between the direct ancestors and the collaterals in which the unit value in the former be called one and the unit value in the latter be called 1.22, it would seem that the validity would be greater than if the unit value were considered 1 in all cases as Galton proposes.

NUMBER OF DISTINGUISHED RELATIVES IN EACH DEGREE OF KINSHIP

It now becomes necessary to examine more carefully the method of determining distinction, since three handbooks, covering somewhat different periods, and with different selective standards, were used.

Both editions of "American Men of Science," that is, the editions of 1903 and 1910, were consulted, and biographies found in either were counted. Those found in the original edition of Appleton's "Cyclopedia," published in 1887-8, together with the appendix of 1890 and

* X equalling the number that must be added to one to make up for those who die before reaching maturity or who do not reproduce though they reach maturity.

all ten volumes of "Who's Who in America" covering the period from 1910 to 1918 were also included. The first edition of "American Men of Science" contains more than 4,000 men of science, of entire North America, the second edition of 1887-88 of Appleton's *Cyclopedia of American Biography* contains "above 15,000 prominent native and adopted citizens of the United States, including living persons, from the earliest settlement of the country." In the appendix of 1890-00 "will be found nearly 2,000 notices of Americans who won renown in the war with Spain . . . and of persons of the New World who have become prominent in the peaceful activities of life during the decade" between the appearance of the two publications. The ten volumes of "Who's Who in America" contain 36,915 biographical sketches. The first volume contains 8,602 biographies, while volume 10 has 22,968. It is evident that the three publications have varying standards of selection, and it becomes necessary to get some statement of the degree of fineness of selection represented by each.

Appleton's "*Cyclopedia*" covers a period of nearly four hundred years. The small population in the early periods with which it is concerned, and the probability that the later periods, namely, the periods during which the grandparents and older fathers of the men of science might have been included, are unduly favored has led the writer to assume a fineness of selection of double that of "Who's Who in America," or one in 2,500 of the generality. Whether this guess has any great validity does not greatly affect the major part of the results in this chapter. If the reader has reason to doubt the proportion, the comparisons of the grandparents with the other relatives may be ignored. The grandparents are the only important group affected.

The ten volumes of "Who's Who in America" that were used are reported by the editors (see preface of Vol. 10, 1918-19) to contain 36,915 individual biographies for a period covering nearly 20 years. The varying numbers

in the different volumes do not correspond in relative size with the changes in population. The population of the United States in 1900 was 75,000,000, in 1910 it was 92,000,000, in 1920, if the growth followed the curve of growth during the two preceding decades, 110,000,000. The ratio of 8,602 to 75,000,000 is approximately 1 to 8,700. The ratio of 22,968 to 92,000,000 is 1 to 5,243 for the generality. For 1912-13, it is 18,794 to 94,000,000 estimated or 1 to 5,000 of the total population. Since the majority of the biographies of relatives found in "Who's Who in America" are in the later editions, and since the editors omit mention in each succeeding edition of a considerable number of those in a previous edition, the ratio of 1 to 5,000 will be used.

Of the 498 relatives of distinction there are 33 whose biographies are found in "American Men of Science" exclusively, and, owing to the specialized requirements for inclusion, this book is used only for special cases described below. No special consideration is given, therefore, to the fineness of selection, other than that used in part II.

Table VIII gives what seems to be the most important facts concerning the distribution of relatives of distinction in the various relationships. Some of the reasons for limiting the comparisons to the specific relationships have been given and certain justifications for including the fathers, who are direct ancestors, with the others who are collateral relatives have been implied. The full number of fathers who reached the required average age is probably less than the number of brothers found to have reached this age. However, practically all fathers had had full opportunity to become distinguished, whereas not all brothers and first cousins had. On the other hand, the fathers who died before the first issue of "Who's Who in America" had less opportunity to be included in other than Appleton's "Cyclopedia." The uncles present somewhat the same problem as the fathers, except for number.

The sons, daughters, nieces and nephews are excluded from this comparison by age. Diminishing birthrate also makes such direct comparison of the younger members with the older impossible.

TABLE VIII

DISTRIBUTION OF DISTINGUISHED RELATIVES ACCORDING TO DEGREE OF KINSHIP

Relationship	Distinguished Relatives (1)	Number of Relatives Reduced to Comparable Ratios (2)	Facts of Column Two Expressed in Per Cent. (3)
Brothers and sisters.....	140	140	50.5
Fathers and mothers.....	78	78	28.2
Uncles and aunts.....	68	34	12.3
First cousins.....	100	25	9.0
Total.....	386	277	100.0

Distribution of Males

Brothers.....	127	127	49.4
Fathers.....	75	75	29.1
Uncles.....	64	32	12.5
Cousins.....	93	23	9.0
Total.....	159	257	100.0

Distribution of Females

Sisters.....	13	13	65.8
Mothers.....	3	3	15.2
Aunts.....	4	2	10.1
Cousins.....	7	1.75	9.0
Total.....	27	19.75	100.0

Distribution of Males with Grandfathers Included

Brothers.....	127	127	44.9
Fathers.....	75	75	26.5
Uncles.....	64	32	11.3
Grandfathers.....	52	26	9.2
Cousins (male).....	93	23	8.1
Total.....	411	283	100.00

Since all of the 52 distinguished grandfathers were recorded in Appleton's "Cyclopedia" and since it was

assumed that the fineness of selection of that handbook was greater than the other handbooks, it seems probable that the per cent. column is invalid in that relationship. There remain the more valid differences in the brother and cousin relationship and in the father-uncle groups.

According to the figures in Table VIII, a person from the brother-sister relationship is almost twice as likely to be distinguished as one from the father-mother relationship, four times as likely as one from the uncle-aunt group and between five and six times as likely as one from the cousin group. The females are too few in number to make such comparisons valid for them. They are given in the separate section of Table VIII because the reader may be interested in their distribution in spite of the small number. Probably the most valid difference is that found in the comparison of the number of brothers and cousins who obtained a position in the starred group. From four times as many male cousins as brothers came fewer starred men.

I have computed similar ratios from the proportions reported by Galton⁵ in his study of relatives of living fellows of the Royal Society whose names appeared in the year book of the society in 1904. Only male relatives are represented, and are as follows:

TABLE IX

	Number	Number of Relatives Reduced to Comparable Ratios	Expressed in Per Cent.
Brothers.....	104	104	40.3
Fathers.....	81	81	31.4
Uncles.....	97	48.5	18.8
Cousins.....	99	24.75	9.5
Total.....	381	258.25	100.0

In any judgment of the validity of the differences given above it is well to keep in mind the fact that the near relatives are more likely to be recorded and reported than

⁵ Noteworthy Families, p. xl.

the more remote. One might say that completeness of data is correlated directly with closeness of relationship, owing to the less exact knowledge concerning the more remotely related. Omissions are more likely to occur in the cousin relationships than in the brothers and more likely in the uncle relationship than in the fathers.

Something of a check on results already given may be had by comparing the distribution of nephews and nieces with sons and daughters. Both groups should be comparable so far as age and numbers are concerned. Furthermore, all handbooks may be used since all persons concerned have had equal opportunity to achieve a place in the various lists. None is included in Appleton's "Cyclopedia."

TABLE X

Relationship	Number of Those Distinguished	Reduced to Comparable Ratios	Reduced to Per Cent.
Sons and daughters.....	18	18	75
Nieces and nephews.....	12	6	25
Total.....	30	24	100

The small number in each of the two groups does not permit any great confidence in reliability of the ratios, but the results are in agreement with the previous table. Table IV shows that five of the sons are found only in "American Men of Science." It might, therefore, be argued that a contributing factor causing the larger number of sons to be distinguished is the direction of the work. Sons, at least English sons, are said to be more likely than not to follow the occupation of the father. Since "American Men of Science" is restricted to scientific people and is a less fine selection than "Who's Who in America," the sons of scientific men are more likely to be included than sons and daughters of the uncles and aunts. If we eliminate those found only in "American Men of Science," we have the following:

TABLE XI

	Number Distinguished	Reduced to Comparable Ratios	Reduced to Per Cent.
Sons and daughters.....	13	13	70.3
Nieces and nephews.....	11	5.5	29.7
Total.....	25	18.5	100.0

It will be seen that the per cent. ratios remain substantially the same.

It is likely that the sons and daughters who are distinguished are more completely recorded than the nieces and nephews. The fact remains that these data are in agreement with those of all like studies. The nearer the kinship the greater the resemblance in distinction, and if distinction means special performance, the greater the resemblance in performance.

RELATIONSHIPS MORE REMOTE THAN FIRST COUSIN

Numerous relatives of more remote degree than first cousin were reported and others were discovered by the writer. There were 60 first cousins of the parents of the men of science. Of these, 31 are cousins of the father and 29 cousins of the mother. The numbers are consistent with the other data, but the possibilities of error and incompleteness make the account of these and other remote relatives unusable at present except in the study of specialization of inheritance. The tedious and exacting work of deciphering relationships in remote degrees make the usefulness of doing so questionable in the present case.

There are 53 great uncles and great aunts, that is, uncles and aunts of the parents of the scientific men. This, again, is in agreement with the rest of the data. There are 21 great-grandparents. There are 82 relatives of a degree more remote than any mentioned and 43 of remote relationship, but of a degree not yet determined. A simple summary of these extra-statistical relatives is as follows:

TABLE XII

First cousins of parents:	
(1) Cousins of father	31
(2) Cousins of mother	29
Great-uncles and aunts:	
(1) Uncles of father	28
(2) Uncles of mother	25
Great-grandparents:	
(1) Grandparents of father	8
(2) Grandparents of mother	13
More remote than any listed above	82
Total	217
Relationship unknown but known to be at least as remote as cousin of parent	
Total	260

THE NUMBER OF PATERNAL AND MATERNAL RELATIVES OF DISTINCTION

Table XIII gives the distribution of relatives of distinction in two groups, the paternal and the maternal. The equality of the two groups is obvious. The differences in specific relationships, such as grandparents and cousins, may be of significance, but none is known. The difference in favor of the MF is, in fact, striking, but if explained as indicative of some advantageous maternal inheritance, some explanation for the size of the FBS group must be found.

TABLE XIII

Relatives on Paternal Side Fathers Omitted	Relatives on Maternal Side Mothers Omitted
FB	MB
FSi	MSi
FF	MF
FM	MM
FBS	MBS
FBD	MBD
FSiS	MSiS
FSiD	MsiD
Total	Total

MORE REMOTE RELATIVES

Cousins of father	Cousins of mother
Uncles of father	Uncles of mother
Grandparents of father	Grandparents of mother
Total	Total

The perfect agreement in the totals of the more remote relatives is indicative of a high degree of validity in the data, as are the totals in the near relatives account. The evidence for the truth of this statement is found in Galton's studies. His early studies, in which remote relationships were used, showed paternal relatives predominating over maternal at a ratio of seven to three. This ratio held closely for five of the eight groups of distinguished men. In two of the other three the differences were greater, being 95 to 6 for 16 relatives of great poets and 85 to 15 for 20 relatives of artists. The divines, however, showed an opposite ratio of 27 to 73.

Galton seemed to take these differences rather seriously and offered some curious explanations, such as possible lack of feminine attraction in women of families of high intellectual merit. But in his later work on "English Men of Science," he says:

As regards the relative influence of paternal and maternal lines I find close equality. My method of comparison is by setting off paternal grandfathers and maternal uncles, no other degree of kinship being available for the purpose. My results for 100 scientific men are paternal grandfathers, public characters, 10, of high private reputation 3, paternal uncles 13 and 8, making a total on the paternal side of 34. On the other hand, the maternal grandfathers are 11 and 4, maternal uncles, 15 and 7, making a total on the maternal side of 37. . . . In *Hereditary Genius*, p. 196 having fewer cases to deal with I extended my inquiries to nephews and grandsons, and in a second table to great-grandparents, grandsons and other equally remote degrees, but this latter was confessedly of little value.⁶

The similarity in paternal and maternal groups holds in the case of science. There is a difference in favor of the maternal group, but it is thought that this difference is within limits determined by chance factors. The total number in the paternal group is 117, of whom 30.8 per cent. are classed as people of distinction in the field of science. The total number in the maternal group is 110, of whom 36.3 per cent. are classed as people of distinction in the field of science.

From a common-sense point of view these similarities are certainly unexpected. One would think that the di-

⁶ *English Men of Science*, 1874, p. 72.

TABLE XIV

MATERNAL AND PATERNAL RELATIVES DISTINGUISHED IN SCIENCE AND IN
FIELDS OTHER THAN SCIENCE

Paternal			Maternal		
	Science	Non-science		Science	Non-science
FF.....	3	14	MF.....	10	25
FM.....		1	MM.....		1
FB.....	7	26	MB.....	9	22
FSi.....		4	MSi.....		
FBS.....	21	24	MBS.....	10	10
FBD.....			MBD.....	1	
FSIS.....	5	10	MSIS.....	9	9
FSID.....		2	MSID.....	1	3
	36	81		40	70
Totals.....	117			110	
Differences in per cent.....	30.8	69.2		36.3	63.7

rection of a man's work is more likely to be directed by paternal social inheritance than maternal. The son has direct contact with the occupational activity of the father; his contact with the occupations of those on the maternal side are indirect in the sense that the mother is not likely to be engaged in a specific field other than domestic duties. Explanation can be made from the sociological or biological points of view; the fact remains that whatever environmental factors are causes of the direction and extent of achievement, there is no evidence of differential influence in paternal and maternal directions.

It is not unreasonable to expect that future ratings of youthful individuals for whom psychologists will predict a future will take account of the performance of their relatives. It is being proposed that more just methods of insurance would be in force if differential ratios were allowed on the basis of the length of life of the parents and grandparents of the person desiring insurance. Biologists and actuaries propose to predict length of life by "performance" of near relatives. It may be possible

to equate the values of the different degrees of relationship as an item in the prediction of achievement.

The method used in this study has serious limitations, but in the present state of ignorance and difficulty of making measurements of the performance in question it gives results that are believed to be a distinct contribution to the fund of information on family resemblances. It may be that adequate measures of high intellectual performance will soon be discovered and perfected, but an enormous amount of measuring must be done before ideally scientific methods can give the data equivalent to that contained in this study. The long period concerned in the history of one generation, the difficulty of making objective measurements on closely related, and much more on the remotely related, together with the expense and persistence required, justifies the present method in spite of the limitations. We are referring now to intellectual performance of such an order that the life history of the individual becomes of public interest.

SUMMARY

The data show (1) that a brother of a man of science is twice as likely to be distinguished as a father, four times as likely as an uncle and about six times as likely as a first cousin, and offspring three times as likely as nieces and nephews; (2) that paternal and maternal influences are not unequal; (3) that the number of relatives in the remote degrees though not strictly comparable show results consistent with the more complete accounts of those in the nearer.

(To be continued)

FAMILY RESEMBLANCES AMONG AMERICAN MEN OF SCIENCE

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IV. RESEMBLANCE AND THE DEGREE OF DISTINCTION

It will be remembered that the starred men were arranged in an order of merit by statistical methods. In this arrangement the total number falls into four convenient groups:

These are: I. those among the leading hundred of our scientific men; II. those among the second and third hundreds; III. those below this rank in the thousand; IV. those who in the second arrangement fell below the thousand, * * *. The first three groups cover about equal ranges of merit, and this also holds in a general way for the fourth group.¹

The positions attained are not permanent. Men advance or lose in relative position according to the merit of their performance as judged by their fellows. Whatever the variability of the position may be it seems desirable to determine the family resemblance of the different groups owing to the unique fact of the order of merit arrangement, an order that has definite objective validity.

Table XV gives the results of the comparison of the four groups according to the number with relatives of distinction.

TABLE XV					
Groups	I	II	III	IV	Total
Number in each group who replied.....	78	174	552	152	956
Number with relatives of distinction.....	25	57	137	37	256
Per cent. with distinguished relatives...	32.1	32.8	24.8	24.3	26.8

The two upper groups have in proportion to their numbers more among them with relatives of distinction. Aside from the first group the per cent. is progressively

¹ Cattell, *Pop. Sci. Monthly*, May, 1915.

less for the four groups. Since the positions are variable and the numbers in the different groups small it is interesting that these dissimilarities should be found. If groups one and two are combined and compared with three and four combined, the validity of the comparison should be increased; the numbers in the two groups are larger and the possibility of variability of position lessened. This arrangement makes a comparison of approximately the upper quarter with the lower three quarters. Thirty-two and five tenths per cent. of the 252 in the upper quarter and 24.7 per cent. of the lower three quarters had relatives of distinction. Seventy-six per cent. as many of the men from the lower three quarters as from the upper quarter are thus represented by relatives as defined. The validity of this ratio of 4 to 3 is not known but may be inferred from the probable errors of similar ratios in the table XVII.

Table XVI gives the comparison of the four groups in terms of the number of relatives of distinction instead of scientific men found to have such.

TABLE XVI

Groups	I	II	III	IV	Total
Number of replies.....	78	174	552	152	956
Number of relatives of distinction.....	45	105	278	70	498
Number of distinguished relatives per hundred replies	57.7	60.3	50.4	46.0	52.1

The differences have the same ranking order as those shown in table XV; the value for group one is slightly less than group two and groups three and four are progressively smaller than two or one. Compared as two groups those from the upper quarter have 59.5 and the lower three quarters 49.4 relatives per hundred men reporting. The larger group has 83 per cent. as many as the smaller or "upper quarter" group.

Table XVII gives the distribution of relatives according to the relationship and distinction of the men whose relatives they are. In this table the upper quarter is compared with the lower three quarters.

TABLE XVII

Relationship.	Number of relatives per 100 men reporting.		Per cent. values of column two in terms of col- umn one.
	Upper quarter.	Lower three quarters.	
Brothers and sisters.....	20.24	15.34	76
Sons, daughters, nieces and nephews	3.97	2.98	75
Parents	10.32	7.81	76
Uncles and aunts.....	7.54	6.96	92
Grandparents	6.35	5.40	85
Cousins	11.11	10.94	99
Total	59.53	49.43	83 $\pm$ 2.56

The results show an almost perfect 4-3 ratio for the three groups of near relatives and it is just those relationships that are the most significant. There is no valid difference shown in the cousin relationship. If these differences are due primarily to environmental factors, or to organic, or in part to both, it is important that we know it, but first of all it is important that we know such differences exist.

SUMMARY

The results show (1) that 32.5 per cent. of those in the upper quarter and 24.7 per cent. of those in the lower three quarters of the starred group have relatives of distinction as defined; (2) that the lower three quarters have 83 ± 2.56 per cent. as many relatives of distinction as the upper quarter.

V. THE SPECIALIZATION OF RESEMBLANCE

Table XVIII gives the distribution of relatives of men of science according to kinship and number who are distinguished for work in science. Those found only in "American Men of Science" have been omitted from this table owing to the constant error in favor of the workers in science that such inclusion would make.

TABLE XVIII

Relationship.	Total number of Distinguished Relatives.	Number of Workers in Science.	Per cent.
Brothers and sisters.....	140	60	43
Sons and daughters.....	14	12	86
Nieces and nephews.....	11	6	55
Parents	78	30	38
Uncles and aunts.....	68	16	24
Grandparents	54	13	24
Cousins	100	42	42
Total	465	179	38 ± 5.3

About 43 per cent. of the 140 comparable brothers and sisters are known for their work in science. Almost the same ratio holds for cousins. That for the parents seems to be less but it is really greater since the handbook from which most of the latter biographies come has about half the relative number of people of science that "Who's Who in America" has. The same is somewhat true for the aunts, uncles and grandparents. The number of workers in science included in Appleton's *Cyclopedia* was estimated by counting the number in the first five hundred. This number proved to be 37, or 7.4 per cent. of the total.

The striking resemblance in the case of the sons and daughters is probably not of valid significance owing to the small number of cases. That such resemblance should exist now when science is super-respectable is to be expected, but that it should exist in the grandparent relationship is certainly interesting, especially since 10 of the 13 grandfathers are fathers of the mothers of the men of science. Eight of the 13 are known for work in the same or closely allied sciences in which their grandsons have won renown.

Any thorough-going investigation of specialization of resemblance would require a clear definition of the function to be measured and a scale for use in measuring the amount found in any individual. There should be, say, a knowledge of what one means by astronomy and an accomplishment test by which any astronomer's work

could be measured. Obviously no such exact methods are available. We can, therefore, do no better than use these terms in the usual commonsense meaning and assume they represent somewhat similar performance. This is confessedly a rough and imperfect method and will probably become increasingly so owing to the increased overlapping of the different sciences.

No little effort was made to arrive at some method of grouping the sciences according to a classification that takes care of the overlapping. That finally adopted divides the twelve general divisions into two groups, (1) those of the more mathematical or physical sciences, (2)

TABLE XIX
DISTRIBUTION OF DISTINGUISHED RELATIVES OF MEN OF SCIENCE ACCORDING
TO THE DIRECTION OF THEIR WORK AND THE DIRECTION OF THE
WORK OF THE MEN WHOSE RELATIVES THEY ARE

Direction of work of dis- tinguished relatives	Direction of Work of the Men of Science Who Have Distinguished Relatives												Total
	Astron.	Chem.	Geol.	Math.	Physics	Anat.	Anth.	Bot.	Path.	Physiol.	Psychol.	Zool.	
Astr.	4.5	1.0		.5	1.0				.3		.5		7.8
Chem.		10.0	4.5	.5	3.5		.5	1.0	2.0			4.5	26.5
Geol.		4.5	14.5	1.0	2.5				1.0	2.0	.3	2.0	27.8
Math.		1.0	1.0	3.0	1.5			.3			.5	.5	7.8
Physics	1.0	4.5	.8	1.5	18.3		1.5	2.3	3.3	.5	2.0	5.5	41.2
Anat.	1.0	4.0	1.3		.8	4.0		1.0	6.5	1.0	.5	2.3	22.4
Anth.	1.0	1.3	1.2						1.3	1.0	.5	1.8	8.1
Botany	1.0	5.5			4.0	1.0		12.0	1.5		1.5	1.0	27.5
Path.		2.8	2.3	.5	6.8			1.0	5.3	3.0	1.5	3.8	27.0
Psychol.									1.3		3.0	1.0	5.3
Zool.		2.5	1.0		3.5	1.0		3.0	1.3	.5		9.0	21.8
Art	1.0	5.0	3.0	1.0	2.0				1.5	2.0		4.0	19.5
Educ.	1.8	5.2	2.3	1.5	1.7	2.0	1.0	1.3	1.0	1.0	4.5	3.0	26.3
Physiol.					1.0		1.0			.5		.5	3.0
Invent.		.5			.3								.8
Law		13.0	4.8	1.0	10.5			2.5	6.3		3.0	6.8	47.9
Lit.	1.8	10.2	11.0	6.0	9.5		1.0	5.8	3.1	2.0	3.5	10.5	64.4
Polit.	2.4	4.5	2.3	8.5	5.3	.5		.5	.3	.5	2.0	.8	27.6
Relig.	1.0	10.7	11.4	1.0	5.8			1.3	.8	4.0	3.0	5.7	44.7
Trade	.5	5.3	2.8	1.0	3.5	.5		3.0	1.5	1.5	1.7	2.0	23.3
War		4.5	.8	1.0	.5	2.0		1.0	.7	.5		6.3	17.3
Totals	17.0	96.0	65.0	28.0	82.0	11.0	5.0	36.0	39.0	20.0	28.0	71.0	498.0

those of the biological sciences. Astronomy, chemistry, geology, mathematics and physics make up the first group and anatomy, anthropology, botany, pathology, physiology, psychology and zoology the second. It may be that the geologists are somewhat misplaced; if so, they would, it seems, be more misplaced if put with the biological sciences.

Table XIX gives the distribution of relatives according to the direction of their work and according to the work of the scientific men whose relatives they are. If a relative is known for work in two directions each is given a fractional value of one half; if in three directions each is given a value of one third.

The first column gives the distribution of 17 relatives of astronomers. Four and five tenths is the value for the number distinguished in astronomy, 1 in physics, 1 in anatomy, 1 in anthropology, 1 in botany, 1 in art and so on. The second column gives a similar distribution of 96 relatives of the chemists. The others follow in order.

The details of table XIX are given more objective form in table XX. Here, instead of the raw numbers and details within each group the per cent. values of the three groups are given in a form that makes direct comparison possible. The astronomers, for example, have

TABLE XX

PHYSICAL SCIENCES

	Astron.	Chem.	Geol.	Math.	Physics	Total
Physical sciences	32	22	32	23	33	28 ± 1.5
Biological sciences	18	17	9	2	20	14 ± 2.0
Fields other than science.....	50	61	59	75	47	58 ± 3.0
Total	100	100	100	100	100	100

BIOLOGICAL SCIENCES

	Anat. and Anthrop.	Bot.	Path.	Psychol.	Physiol.	Zool.	Total
Physical sciences	12	10	17	13	12	18	$15 \pm .7$
Biological sciences	44	47	44	30	25	27	35 ± 2.4
Fields other than science	44	43	39	57	63	55	50 ± 2.4
Total	100	100	100	100	100	100	100

17 relatives, of whom 32 per cent. belong to the physical science group, 18 per cent. to the biological sciences and 50 per cent. to the group "other fields than science."

Fifty-six per cent. of the 956 men in the group belong to the physical sciences and 44 to the biological sciences. This is the distribution for the thousand and is the approximate distribution for the workers recorded in "American Men of Science." There were, therefore, at the time of the study more workers in the physical sciences than in the biological in about a 5 to 4 ratio. Instead of the ratio that might be expected as a matter of chance, namely, the 5 to 4, there is a 2 to 1 relationship with significant reliability for the relatives of the physical science group and a 3 to 7 relationship for the biological sciences. It seems incredible that these resemblances in the direction of work of a group of scientific men and their near relatives should be due to organic resemblance. However, the resemblances are there whatever the valid explanation.

Lester F. Ward, the great apostle of the doctrine of the effectiveness of environment in controlling human conduct, says:

In certain of the arts special aptitudes are of course presupposed, and this is probably true for that great art called literature, but in the various sciences, outside of mathematics, this is not so much the case and almost any one with proper training and adequate facilities can prosecute scientific researches.²

A somewhat similar opinion concerning mathematics has been expressed by Cattell, as follows:

My general opinion is that certain aptitudes, as for mathematics and music, are mainly innate, and that kinds of character and degree of ability are mainly innate, but that the direction of the performance is mainly due to the circumstances and that environment imposes a veto on any performance not congenial to it.³

It may be "that almost any one with proper training and adequate facilities can prosecute scientific researches," but the results of this study show that the

² Ward, *Dynamic Psychology*, p. 241.

³ *Science*, N. S., Vol. 24, pp. 732-744.

relatives of scientific men are many times as likely to do so as men of the generality. Brothers, for example, of men of special performance in science are over 200 times as likely to show special performance in science. Moreover, near relatives are more than twice as likely to follow a dissimilar field as defined.

What of the dissimilarities? It may be that the congenital equipment which determines the performance in fields other than mathematics is also somewhat unitary, thus allowing unusual success in literature, law, education, politics, trade, science and the like. Why, for example, should the mathematicians be well represented in the field of politics, particularly diplomacy? Of their 28 distinguished relatives more are distinguished in this direction than in all the sciences; in literature they have a value of 6 and in mathematics only 3. If Galton had examined the relatives of his judges, he would no doubt have found some well known for their work in literature or politics or other fields into which their opportunities had led them. Even the men of science who are included in this study as members of the starred group are by no means limited in their special achievement to the science in question. Dean Roscoe Pound, of Harvard, is internationally known for his work as a lawyer. He is an educational administrator of recognized merit. His sister is distinguished in literature. What is one to say about the specialization of resemblance here?

I doubt if there is a family here reported in which the performance of the various individuals is not different in kind. The astronomers, for example, have three families, the Pickerings, the Searles and the Doolittles, whose work is primarily in astronomy. But, one member of the first is known for his work in ethnology and botany and one of the second is known for his work in religion. The distinguished relatives of Percival Lowell run almost the entire gamut; the brother of Ormond Stone was the head of the great Associated Press news-gathering system. Certainly these differences are as striking as the similarities that have been expressed as averages, or

as the individual cases as they stand in the lists of names. The botanists, on the other hand, have a great array of resemblances in the specific field of botany.

In discussing the number of workers in religion whose offspring became men of science, Galton says:

Can then religion and science be in harmony? It is true that their methods are different; the religious man is attached by his heart to his religion, and can not bear to hear its truth discussed, and he fears scientific discoveries which might in some slight way discredit what he holds more important than all the rest. The scientific man seeks truth regardless of consequences * * *. These are indeed important differences, but the two characters have one powerful element in common. Neither the religious nor the scientific man will consent to sacrifice his opinions to material gain, to political ends, nor to pleasure. *Both agree in the love of intellectual pursuits* and in the practice of a simple, regular, laborious life, and both work in a disinterested way for the public good.⁴

The italics in the above quotation are the present writer's. There may be, and probably are, different kinds of intelligences. Just as there are *memories*, rather than *memory*, there are various types of intellectual performance, but these types, whatever they are, must have many elements in common. The lawyer, the minister, the educator and the man of science must respond to fine differences and shades of differences. Similarities in the finer elements of situations must be seen. The average child of three can not respond to the element or concept of "fourness." He may be able to respond by the concept "more-than-two." If he is found to respond not only to "fourness" in a group of objects of that number but to "fiveness" or "sixness" we are justified in considering him gifted in ability to do intellectual operations involving number concepts.

Professor Woodworth, in his book "Dynamic Psychology," shows how Newton recognized a similarity between the falling apple and the moon revolving about the earth. There are many persons who can not respond to this similarity with the aid of skilled teachers. So, "if the environment places a veto on any activity not con-

⁴ Galton, "On the causes which operate to create scientific men," *Fortnightly Review*, Vol. XIX, pp. 345-351.

genial to it" the intellectual capacity places a veto on any environment not congenial to it. If the writer understands Professor Woodworth's argument, the mere possession of a capacity tends to its expression because the organism is "set" toward a certain activity and continues in a state of dissatisfaction until the reaction for which it is organized and prepared by original nature is in operation. Thus, if a person is so organized that he forms language habits easily and quickly he will take pleasure in forming them, if he is able to see differences in plant and animal growth, human behavior, and the like, he is ill at ease unless he is so doing and is satisfied when so doing.

If it be assumed that the performance of the individual is predicated on his congenital equipment there is still the question of how far that equipment will resemble the equipment of other individuals coming from the same or nearly related groups of germ cells. The resemblances of persons in closely related groups have been measured and shown to be many times greater than the resemblance of people chosen at random. What these resemblances mean may be left for future investigations. If society can increase its workers in science over 200 times by giving all children the same average advantages that the brothers of men of science are thought to have had, one answer is obvious. Whatever the explanation, there is no mistaking the implication that the people from the professional classes, and most of all men of science, should be given every opportunity to raise large families. The fact remains that the near relatives of these men produce far more than their share of the best that civilization offers, and it should be made easy for them to reproduce themselves, at least, until more of society can enjoy the supposed privileges enjoyed by the professional classes.

SUMMARY

The results show (1) that 38 ± 5.3 per cent. of the distinguished relatives of men of science show special per-

formance in science, which is about three times that of the distinguished people of the generality as recorded by "Who's Who in America," (2) that there is specialized resemblance in the direction of the kind of science, physical and biological—instead of the distribution of 5 relatives in the physical sciences to 4 in the biological which is the distribution in "American Men of Science," the men from the physical sciences have 2 relatives in the physical sciences to 1 in the biological, while the men of science in the biological group have 3 relatives in the physical to 7 in the biological, (3) that the dissimilarities offer perplexing data if one is to assume that resemblances are due to unitary factors of organic equipment.

VI. THE RELATIVES OF WIVES OF MEN OF SCIENCE: ASSORTIVE MATING

The two quotations given below, one from Galton and one from Ward, throw into relief an interesting question of fact. Galton claims to have been impressed with the evidence in biographical accounts of eminent men of assortive mating in the direction of intellect. He says:

The great fact remains that able men take pleasure in the society of intelligent women, and, if they can find such as would in other respects be suitable, they will marry them in preference to mediocrities.⁵

Ward, the great proponent of the doctrine that genius is "in things" rather than men, says:

The children of an eminent man are only half his. Half of every one of them belongs to his wife. And who is his wife? A person from entirely different stock. As geniuses are rare at best, the chances are enormously against her being a genius too. But there is a law of nature that partners choose their opposites. Galton is not ignorant of this law but he questions it.⁶

Here we have objective evidence, and to an extent in quantitative form, that Galton was correct. And who are the wives of the men of science? Of 919 of them, 57 are daughters of distinguished fathers, some of whom are world celebrities. Twenty-one of the wives are them-

⁵ Hereditary Genius, 1892, p. 316.

⁶ Lester F. Ward, Applied Sociology, p. 119.

selves women of distinction; 48 are sisters of men of distinction; 55 are nieces of distinguished men and 26 are granddaughters of the same sort, nor do these exhaust the relationships as table XXII shows.

Denial of assortive mating is not the only mistake of the sociologists. Ignoring it has resulted in misinterpreting apparent evidence of persistence of desirable traits coming from one individual. Consider the following in this connection:

Remember the size, ages and financial conditions of the family when the father died—the sons being aged eight, eighteen and thirty—and then consider the fact that the three sons graduated from Princeton, and five of the daughters married college graduates, three of them Yale, and one of them Harvard and one of Princeton.⁷

The point made is that in spite of unusual obstacles three sons of the famous Jonathan Edwards graduated from college and five of the daughters showed special performance by marrying college men. It is not unlikely that the performance of the husbands of the five daughters was equal to that of the three brothers and that hereditary characters of equal value were carried by husbands and wives. Even a casual reading of the history of the Edwards family will show how a considerable portion of the stock might have been kept up by such marriages as the five original daughters made. And what of the Jukes?

THE NUMBER OF DISTINGUISHED WIVES

Of the 956 men concerned, 84 were reported as unmarried, 43 are known to have been married twice and two were married three times. At the time the data were gathered there had been, therefore, 919 marriages. Of these, 21 were with women of distinction as defined. Among the records of the men who did not report, 3 other wives of distinction were noted owing to cross relationship with members of the starred group. Fourteen of the 21 wives are recorded in "Who's Who in America" and 14 in "American Men of Science"; 3 of the latter

⁷ Winship, Jukes-Edwards, 1900, p. 33.

being in the starred group. Fourteen are distinguished for work in science and 6 in literature.

It is not known how many of the women who are recorded in the various handbooks are married but a good many certainly are not. The number of women in "Who's Who in America" is about ten per cent. of that of the men. If every 1,000 men of the generality, belonging to the same age group as the men of science, had among them 14 distinguished wives the handbook containing their biographies would have to have nearly 200,000 accounts of married women of distinction. It is doubtful whether any volume of "Who's Who" used in this study had more than 1,000 such accounts.

DISTINGUISHED RELATIVES OF WIVES

Table XXI gives the details of the distribution of the wives and their relatives (1) according to the direction of the work of their husbands, (2) according to the number having relatives of distinction, (3) according to the number of distinguished relatives.

TABLE XXI

Direction of husband's work	(1) Total wives	Wives with distinguished relatives	Distinguished relatives
Astronomy	42	8	15
Chemistry	158	22	42
Geology	85	19	32
Mathematics	75	8	20
Physics	151	25	42
Anatomy	25	1	2
Anthropology	16	1	2
Botany	93	13	18
Pathology	53	14	31
Physiology	36	7	11
Psychology	39	4	10
Zoology	146	25	48
Total	919	147	273

The figures of table XXI show that 147, or about one in six, of the 919 women had relatives of distinction equal to that of their husbands. Sixteen of the 147 are represented only by children and as there may be some doubt

as to the validity of the comparisons which include the children when the fathers are of known distinction this number may be subtracted, making the ratio about one in seven for the number with distinguished relatives. This is more than one half as great as that of the men themselves. One hundred and thirty-one women have 254 or 1.93 relatives per individual; this is equivalent to the $1.95 \pm .06$ per individual for their husbands.

TABLE XXII

Relationship	Total	Handbooks		Appleton's	Starred group
		Am. Men of Science	Who's Who		
B	48	18	47	4	11
Si	10		10		
S	18	15	13		5
D	1		1		
F	57	12	35	40	19
M	3			3	
FB	28	1	4	27	
FSi	2		1	2	
MB	27	6	15	13	2
MSi					
BS	3	1	3		1
BD					
SiS	1		1		
SiD	1		1		
FF	15		1	15	
FM					
MF	11		1	19	
MM					
FBS	17	2	11	15	1
FBD	2		2		
FSiS	5	2	4		
FSiD					
MBS	14	3	10	4	3
MBD	1		1		
MSiS	9	5	7	2	4
MSiD					
Total	273	65	168	130	37

Table XXII gives the distribution of the relatives of the 147 wives (1) according to kinship, (2) according to the handbook or handbooks in which they are found reported, (3) according to the number in the starred

group. Table XXIII gives a comparison of the per cents. in each handbook and in the starred group in comparison with similar data on the husbands' relatives.

TABLE XXIII

Relatives of men of science	Am. Men of Science	Who's Who in Am.	Appleton's Cyclopedia	Starred group
498	28	62	40	11
Relatives of wives				
273	24	62	48	14

Contrary to expectation "American Men of Science" and the starred group do not have a significantly greater representation among the relatives of the men of science, that is, greater in proportion to the total number of distinguished relatives.

DISTINGUISHED BROTHERS

It is not known how comparable the brothers of the wives are with the brothers of the men of science. Assuming the two groups to be directly comparable the figures show that the brother of a wife of a man of science is about one third as likely to be known for unusual performance as a brother of a man of science. That is, 956 men of science are known to have 146 distinguished brothers; 919 of the wives have 48 such brothers. For the men of science the ratio is about 6.5 to 1; for the wives, 19.2 to 1. Since the brother of a man of science is found to be 73 times as likely as a man of the generality to be included in the handbook, "Who's Who in America," a brother of his wife would be about 24 times as likely to be included. This proportion probably errs in a negative direction. The brothers of the wives are as a group younger than the brothers of the men of science and it is likely that the data on the former group are much less complete than on the latter. Ten of the wives' sisters are distinguished and 13 of the sisters of the men of science.

OTHER RELATIVES

The relative number of distinguished parents is greater than the number of brothers. The men have 78

fathers and 3 mothers of note; the women have 57 fathers and 3 such mothers. The wives have approximately 2 fathers of distinction for 3 such fathers which the husbands have. The uncles and aunts, grandparents and cousins are represented by the numbers 68, 54, 105 for the men, and 57, 26, 48 for the wives. It is obvious that the large differences are in the remote relationships and may be accepted as evidence of greater incompleteness in the data on the relatives of the wives.

SPECIALIZATION IN DIRECTION OF WORK

Not only are men of science likely to choose wives who on the average have more than half as many distinguished relatives as they have themselves but they are likely to choose wives whose relatives show special performance in science. Table XXIV shows the facts for the distribution of the relatives of the wives according to the degree of kinship and according to the number known for work in science. Eighty-eight, or 33 per cent., not counting those found only in "American Men of Science," of the 273 have done work in science. This compares with 38 per cent. for the same data concerning the men of science, a difference much smaller than one might expect.

TABLE XXIV
NUMBER AND PER CENT. DISTINGUISHED IN SCIENCE

Relationship	Total	Number in science	Per cent. in science
Brothers and sisters.....	58	24	41
Sons and daughters.....	14	12	86
Parents	60	25	42
Uncles and aunts.....	56	12	21
Nephews and nieces	5	1	20
Grandparents	26	4	15
Cousins	46	10	22
Total	265	88	33 $\pm$ 5.9

The relative number of brothers in the two groups is exactly in the ratio of 1 to 1, that is, 24 in science and 24 in fields other than science; for fathers it is 1 to 1.3; for uncles, 1 to 3.8; grandparents, 1 to 6.5, and for first

cousins, male, it is 1 to 4.3. These interesting results show resemblances that increase with nearness of relationship although the different groups are not strictly comparable.

Aside from the supposition that men of intellect are attracted by women similarly gifted it is reasonable to suppose that this apparent specialization of resemblance is the result of propinquity. During the mating period sisters of colleagues or daughters of professors are likely to be companions in laboratories and social activities.

DISTINCTION AND DEGREE OF KINSHIP

Table XXV gives the distribution of the male relatives of the wives, (1) according to a coarse grouping of the number in each degree of kinship, (2) the number in each degree of kinship expressed in comparable ratio with the number in the brother relationship, (3) the same ratios expressed in the per cent. that each is of the sum of all of them.⁸

TABLE XXV

	Total	Comparable ratios	Ratios in per cents.
Brothers	48	48	33.4
Fathers	57	57	39.7
Uncles	55	27.5	19.1
Cousins	45	11.25	7.8
Total	205	143.75	100

With the exception of the brother-father relationships the results are in agreement with those found for the men of science themselves. As has been said, the brother relationship may be incomplete in that those in this degree were too young to have had time to show their performance, or owing to the mechanics of the handbooks and incompleteness of the data reported by the men or to both.

THE WIVES OF THE ZOOLOGISTS

There is a curious distribution of distinguished wives of men of science. The zoologists have 10 of the 21 who

⁸ See section III for explanation of method of determination of ratios.

are included in the statistical data. The marital condition of 144 of the zoologists at the time of the investigation was as follows: 7 were unmarried, 7 had been married twice, 1 had been married three times, making 146 marriages in all. Among these 146, 10 were with women who were or later became distinguished as defined. Eight are listed as workers in zoology, 1 in psychology and 1 in literature.

This may be a chance result. The fact that the number of distinguished relatives of the wives of the zoologists is proportionately about the same as that found for each of the other sciences would seem to make it so. In any event the data are interesting in connection with the following:

Francis Galton long ago pointed out the good results of a custom obtaining in Germany, whereby college professors tended to marry the daughters or sisters of college professors. A tendency of men of science to marry women of scientific attainments or training is marked among biologists, at least, in the United States * * *.⁹

Here we have, probably for the first time, objective evidence that zoologists tend to marry women of scientific attainments or training and that men of science, in general, tend to marry women who come from families of special intellectual performance, particularly in the direction of science.

Perhaps in the near future society will know exactly the chances of obtaining superior individuals from particular matings, assuming that it knows what superior individuals are like. It is not inconceivable that even a democracy will learn to pay a bonus for children from certain matings, trusting to the possibility of persistence of desirable traits in the same. Such a practice would facilitate the rearing and bearing of children of men and women of science if our data mean what they seem to. Now that there is evidence that men and women of science intermarry, thus increasing the chances of offspring resembling them, the suggestion of a bonus should seem less bizarre than upon first thought.

⁹ Popenoe and Johnson, *Applied Eugenics*, 1918, p. 228.

SUMMARY

The data in this chapter have shown (1) that a distinguished man of science is at least 200 times as likely to have a distinguished wife as a man of the generality, (2) that the direction of the performance of the wife is likely to be in science or literature, (3) excluding children, that approximately 1 in.7 of the wives has one or more relatives of distinction, which is more than half as many as the men themselves have, (4) that specialization in resemblance is shown by the fact that 33 per cent. of the distinguished relatives of the wives and 38 per cent. of the same for the men are known for their work in science, (5) that the number of distinguished relatives varies with the degree of remoteness of relationship except in the father-brother groups, (6) that the zoologists have a disproportionate share of the distinguished wives.

VITA

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